ILLUSTRATED

A weekly Journal of

ELECTRIC LIGHT AND POWER, TELEGRAPH, TELEPHONE & SCIENTIFIC PROGRESS.

Vol. 13, No. 26.
February 23, 1889.

NEW YORK, U.S.A.

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ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 13, No. 26. WEEKLY. | NEW YORK, SATURDAY, FEBRUARY 23, 1889. | $3 per annum. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

CHICAGO ELECTRIFIED

BRAVE KNIGHTS OF ELECTRIC LIGHT AND POWER IN COMMAND.

THE EXPOSITION BUILDING CROWDED WITH EXHIBITS AND EXHIBITORS.

A Large Attendance and an Interesting Meeting Expected.

SPECIAL EDITORIAL DESPATCH TO THE ELECTRICAL REVIEW.

GETTING READY FOR THE ELECTRIC LIGHT CONVENTION.

THE OUTLOOK ON MONDAY.

(*Special Despatch.*)

CHICAGO, Feb. 18, 3 P. M.—Four years ago, this month in this city, the National Electric Light Association was born.

This week the city of its birth gives it glorious welcome.

Already there is in attendance many more than ever were present at a former convention, and to-morrow's trains promise to increase the crowd.

President S. A. Duncan arrived Saturday; Secretary A. V. Garratt the previous day. The members of the Executive Committee are nearly all here, and with the other officers will be dined to-night at the Union League Club by the Chicago members.

Chairman B. E. Sunny of Executive Committee has accomplished wonders in completing preparations for the exhibitors. He is receiving many compliments, and is a very busy man.

Roe is here from San Francisco. The Atlantic Coast is represented by about 150 delegates.

The special vestibule train arrived this forenoon. It brought in 58 passengers, about 45 from New York, the others from Philadelphia and Pittsburg. All the passengers enjoyed the trip, it was so quiet and restful, preparing them for the hard work of the convention, which begins to-morrow.

The underground question, evidently, will be a leading one. Chairman Lynch of the special committee, has not yet arrived but is expected Wednesday. The advocates of underground work are present in force. Johnstone, the New York conduit man, is the most lively. It is likely that the convention will not be so emphatic in its opposition to the undergrounding of the wires as at the New York meeting De Camp of Philadelphia, Weeks of Kansas City, Morrison of Baltimore, are all here to oppose wire burial, and there are many others.

City Electrician John P. Barrett is exerting himself on behalf of all visitors, and is succeeding in doing the honors most gracefully.

The city press is remarking on the fine-looking, alert-appearing attendants, with particular attention to the New York crowd!

Niagara Falls is talked of for the next summer meeting. Rhodes, of that place, is working for it, and will likely succeed.

The usual amount of politics is appearing in relation to officers for another year. The sentiment is favorable to the present officers, with locality changes in the Executive Committee.

Stanley, of Bridgeport; Weeks, of Kansas City; Ridlon, of Boston, and your correspondent—the four who were present when the Association was born and have attended every meeting since—are here in all their manly and moral beauty, and wear their honors with becoming modesty.

It will be a great Convention.

C. W. P.

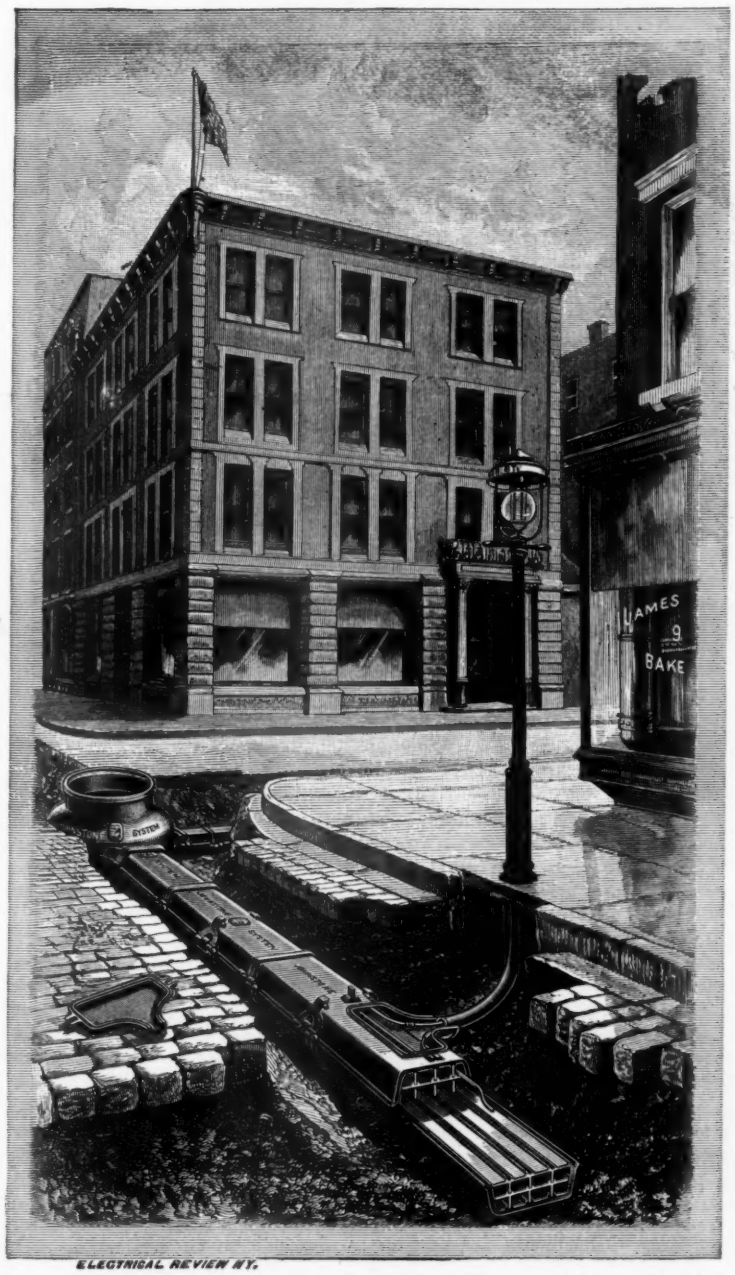

FIG. 1.—THE JOHNSTONE SYSTEM OF UNDERGROUND CONDUITS.—SHOWING MANHOLE AND "A" SIZE OF CONDUIT, WITH STREET LAMP CONNECTIONS.

THE EXPOSITION BUILDING, EXHIBITS, ETC.

The old weather-stained leviathan structure known as the Exposition Building, where many a tumultous assembly has met since its erection in 1872, is now ready for

(*Continued on Page 5.*)

UNDERGROUND ELECTRIC CONDUITS.

THE JOHNSTONE SYSTEM, USED IN NEW YORK BY THE CONSOLIDATED TELEGRAPH AND ELECTRICAL SUBWAY, DESCRIBED AND ILLUSTRATED — INTERESTING INFORMATION FOR AERIAL WIRE OWNERS.

The special features of the Johnstone system, owned by the North American Underground Telegraph and Electric Co., 45 Broadway, New York, are presented to the electrical public in the REVIEW this week for the first time. Undergrounding of wires is one of the chief topics in all electrical discussions, and is a problem that has attracted and is still attracting many bright and capable minds, as well as many that have no conception of the task involved. No one man has devoted more time, energy and persistent effort to an intelligent solving of this problem than has Mr. W. H. Johnstone, president of the above company. That his work has resulted in the use of this system in New York, Philadelphia and Chicago, the three great commercial cities of the Union, is a recognition that must impress every owner of aerial electrical wires, as well as the officials of other cities. The question is before you, gentlemen of the electrical fraternity, and while the REVIEW will never be found advocating that wholesale burial of the wires that is so loudly called for by ignorant and often unscrupulous legislation, it is pleased to record every movement that may lead to the improvement of electrical service, and the increase of its popularity. No one will dispute the beauties of a perfect underground electrical service; but there are many, and they have the best of right to be heard, who protest against having their property ruthlessly impaired without being heard in their own cause. That this system has met with favor even from arc lighting men, who are the most strongly opposed to the burial of their wires, and with probably the best reasons, is shown from the remarks of Mr. A. J. De Camp, of Philadelphia, who stands at the head of the arc lighting of that city. In the discussion of the underground question by the National Electric Light Association in New York last August, Mr. De Camp said:

"I will say in regard to the Johnstone conduit that it is a very good form of conduit, It is expensive, but I believe it is perhaps the best conduit we have. I am free to say, at any rate, that it is the best form of conduit that has ever been brought to my attention; but we have never got anything to put into it yet that answers the purpose."

The illustrations we present in this issue are taken from actual work and present the Johnstone system as adopted in New York. This is the first comprehensive underground system in actual operation we have ever seen, and we are sure the views we present will be noticed with much interest at the present time.

The first effort to construct an underground conduit for electrical wires, following upon the Brooks fiasco, was in 1882 in Chicago, at which time a law was passed preventing the erection of any more poles in the streets of Chicago. The Postal Telegraph Company had at that time constructed their lines from New York to the outskirts of Chicago with no means whatever of reach-

ing the centre; when the American Sectional Electric Underground Company of Philadelphia, W. H. Johnstone being the president of that company, was brave enough to undertake the work, and laid some seven miles of his iron conduit (of a crude character in comparison to the development and improvement of the conduit at the present time) in which there were laid two Patterson cables, which up to this day are serving the Postal Telegraph Company equally as well as when they were put down. This effort and success very naturally created a fever of excitement amongst our active inventors and hundreds and hundreds of systems and ideas of every conceivable character were made known to the public through the medium of the Patent office, but the Johnstone system kept apace with all the necessities as the understandings and requirements were better known.

After the Chicago excitement Mr. Johnstone's company laid about two miles in Philadelphia. The thing was condemned most heartily by all people who had any pretensions to electrical knowledge. Each privilege asked for by the company from the council or the city officials was fought step by step by the overhead interests, but nevertheless the conduit was put down, and while there was no law existing then in Philadelphia to compel the companies to utilize the space provided for them, or to put their wires underground, Mr. Johnstone determined to make a practical demonstration. He therefore organized the Underground Electric Light and Power Company, which occurred in 1883, and put an arc light plant to work immediately, all of the conductors being underground. This enterprise, we are informed, is in full operation to this date. The experience in Philadelphia established for a fact the advantageous mechanical construction of this conduit, which is made in many sections, creating many joints, which would ordinarily suggest leakage, admission of moisture, but put together, as is done with plumbers' putty, makes it secure and is a guarantee against the admission of outside moisture or drainage. These conduits which were laid in Chestnut street, Philadelphia, and very inferior to those laid in the city of New York, in respect to their mechanical construction, have been opened all along the entire line, and Mr. Johnstone informs us that the iron is found to be perfectly dry and in perfect state of preservation, free from rust or corrosion, showing the entire absence of moisture at any time since their burial, a period now of over five years.

The feature that establishes the great availibility and durability of this system is the perfect facility for the distribution of conductors of different electro-motive force from totally independent ducts and each going independent into the house or to the lamp-post. Without such facilities an underground conduit is of no earthly value, because wires to be carried in a cable from one point to another and only utilized at the end, could be laid in the earth in any well constructed receptacle and would answer the purpose just as well as the finest construction imaginable. This system affords, as described and shown, a perfect trunk line system as well as the distributing advantages. The promotors now claim that there is nothing that could be done or desired to be done with a wire overhead that cannot be easily accomplished by this system, underground.

Mr. Johnstone opened the campaign in New York as early as 1883 and his persistent effort and demonstration were the chief elements in causing the passage of the Act creating the present Board of Electrical Control. Therefore what has been accomplished in this direction in the City of New York, can be attributed to him. The same opposition met with in other cities was meted out to him in New York only with greater strength than ever before. It was exceedingly gratifying to those interested in this underground movement, last season to walk up Broadway, and on One-Hundred and Twenty-fifth Street in this city see this very elaborate system of conduits going in the ground. It did not require an expert to stand by and explain to the stranger as he went along, that what they were laying was to put wires in. It showed it on the face.

THE JOHNSTONE SYSTEM IN DETAIL.

Manhole.—The company adopted iron manholes as being more durable and substantial, and preventing the transmission of moisture. A great advantage in the form and plan of the structure of this manhole is its being made in sections or rings of varying widths, starting at the bottom with a solid iron pan, and by simply placing rings in succession, one on top of the other, until the structure thus made has reached a height in its rise towards the surface on a level with the grade at which the conduits lead into the manhole from the several directions. This ring, or section of the manhole, is called the spigot ring. This ring is formed in segments. In order to accommodate any size conduit, the spigots that are to be placed in position of any size aperture (for the conduits leading latterly therefrom) are all of uniform size on the outer edges of the plate, fitting exactly into the spigot ring, taking the place of one of the segments that construct the spigot ring. By this mechanical construction a larger or smaller spigot can be substituted at any time. Surmounting this spigot ring is a hood made of sufficient strength to bear the street traffic, tapering to a proper size opening at the street for the admission of a man.

Conduit.—The conduit system consists of an iron box composed of two troughs, one placed upon the other, as shown, with the longitudinal divisions at the sides, a groove being cast on the edge of the lower trough and a tongue cast on the edge of the upper trough, so made and exact in size that when put together must necessarily result in an exact fit. These sections are five feet in length, as are all the varying sizes of internal capacity. To insure joints being water tight, prior to the laying, all grooves, recessed clamps and abutting ends are filled with what is known as plumbers' putty. The more it is immersed in water the harder it becomes. Its entire reliability for making a tight joint to resist the passage of water has been ascertained by experience and careful observation in conduit structure in continuous operation for over four years. The internal capacity, shown in Fig. 2, is divided up into as many ducts, or apartments, as may be desirable, in the following way:

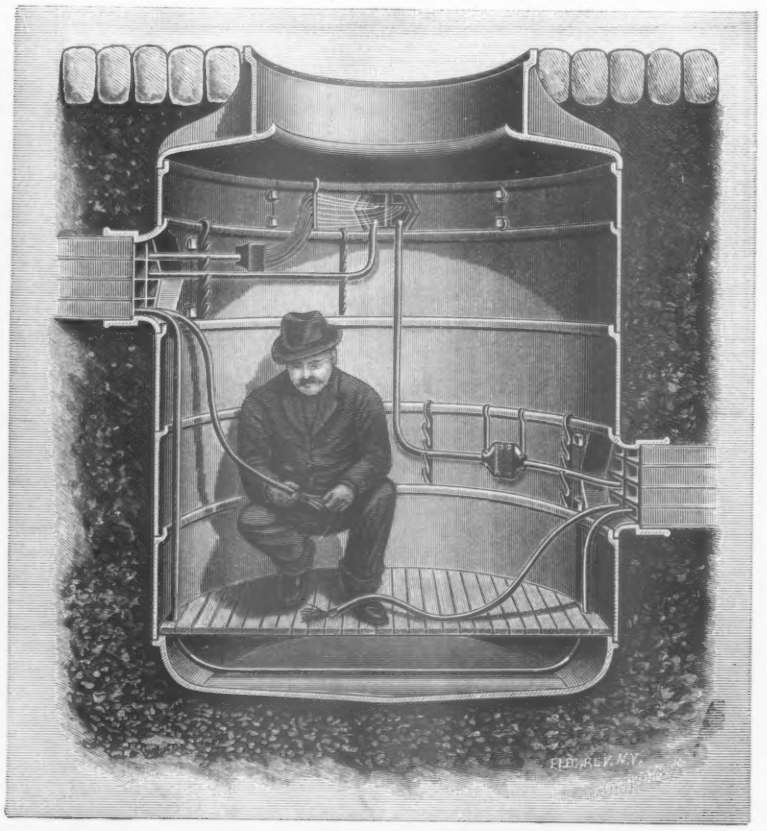

FIG. 2.—THE JOHNSTONE SYSTEM.—IRON MANHOLE—INTERIOR VIEW, SHOWING TEST BOXES AND CONNECTIONS

Grooves are cast inside the bottom of the bottom sections, and corresponding grooves inside the top of the top sections. When the two sections are put together these grooves come exactly opposite each other. If more than one set of ducts are to be provided in any special size of conduit, an iron shelf, two and one-half feet long, with feet cast upon it of the height desired, made to fit exactly into these grooves, is slid into position. On the top of this shelf are corresponding grooves to those in the bottom of the conduit section, and into these grooves a like shelf with feet is placed, until the number to provide for the special number of ducts are pushed into position. This work is performed as the conduit sections are laid and the top sections are placed in their position, following the placing of the shelves, as described, which is not only an easy and expeditious work, but the day laborer can perform it, as it is not possible for the structure to be put together wrong. The rapidity with which this system can be laid is a most favorable feature.

Distribution.—The question of distribution of wires and their easy handling is the one vital question underlying the entire subject and problem of placing electrical conductors underground, and this point is the one to which this company has given the greatest attention, and assert that they have achieved and worked out to a state of completion a mechanical means that enables them to handle wires underground from point to point with perfect facility and convenience. In the course of laying the conduits they place a handhole section in front of each building (see Fig. 3). These handholes are formed in the top sections, consisting of an opening large enough to give free access to the wires in the top ducts, or compartments. This opening is covered with a tight and secured plate, removable at will, so constructed that when a connection is desired to be made with any house, an excavation is made immediatcly over this plate, its location being known by marks upon the curbstones or measurement from the nearest manhole plate (careful records always being kept). The workmen go into the cellar of the building with which connection is to be made, remove a single stone in the foundation, and by means of a system of dirt augers and drills a hole is bored beneath the sidewalk and curbstone to the excavation over the manhole. An ordinary gas pipe of the size and capacity to accommodate that particular building (in the end of which is forced a conical wooden plug) is started in the hole thus bored from the cellar, and driven through to the handhole opening. When arriving in sight it is a very little work with crowbars to raise or lower or bend the pipe sufficiently to allow its proper admission into the handhole spigot provided for its reception. By means of an ordinary rubber tube dropped into the end of the pipe at the handhole, conversation can be carried on with those in the cellar. Directions can then be given as to how far to drive the pipe, and when to stop, etc. The experience had in making a large number of such handhole attachments shows the entire practicability and ease of the operation. The handholes are provided with an extra piece, which is called the handhole spigot, which is placed in position at the time the house connection is made. It extends out from the line of the conduit structure about six inches, forming a bell shape. Within this recess the connection or splice made with any wire, is entirely outside of the line of the duct from which it is taken. This bell spigot piece offers the advantage that after the splice is made, and before the handhole cover is replaced, the space around the splices is filled with a hot insulating material, which becomes hard and impervious, and prevents the passage of moisture or foul gas, that may accumulate in the conduits, into the houses; a thing that must be seriously guarded against. The handhole plan provides also for a separate and distinct opening into any of the ducts on the other side of the conduit structure in respect to the top ducts, as well as to those on the bottom, the idea being to give a separate and distinct duct leading from the conduit to the house. for electric light wires, and a distinct duct for telephone and other services.

Arc Lighting.—The question of electric arc lighting is one that must absolutely be met with ample provisions for both its mechanical and electrical accommodation. The outside ducts provided in the Johnstone system are specially designed for this particular service. The handholes provide openings on either side of the conduit, enabling connection to be made with both sides of the street from one handhole. A company contracting to light the city streets must have a provision to reach their poles on which their lamps are erected (see Fig. 1). A handhole piece is placed in the conduit opposite the point where the lamp post is to be located, and in case of a location being changed, and the lamp post being placed at a point opposite a point in the conduit where no handhole had been placed, they make an excavation five feet long, remove the clamps binding the conduit together, lift up one plain top section, replacing it with a handhole section, in which operation none of the wires passing through any of the ducts are in any wise disturbed. This done, the operation is complete, and ready for the connection between the manhole and the lamp post. This illustrates one of the advantages of the five-foot sections, another being in case of an actual disturbance or defect discovered in the cable that may be passing through the conduit, it can be easily located, and at that point a top section removed lift the shelves out one after the other clear to the bottom, if the defective wire should be so located, allowing the conductors that are in use and operation to swing or suspend from their respective ducts over the point opened. The cable can be repaired by cutting out the defective section and resplicing it. This operation disturbs only the cable in which the defect is found; avoiding the laborious and expensive necessity of drawing the cable clear out from one manhole to another. After the repair is made, the plates, or shelves, can be slid into their original position, the wires adjusted in their respective ducts and the top section replaced with fresh putty, making it equal to its original condition. The simplicity of drawing single wires from the manholes to the handholes, is exceedingly plain. A cable in any service containing a large number of wires, carried from a central station to a manhole at any distance therefrom before it is to be tapped, and at that manhole any number of wires to be used in any (telephone) service in the next succeeding block, would be spliced to the end of the number of wires thus required from that cable, and drawn into the top ducts of the conduit from that manhole to the houses within that block. This compartment being accessible in front of each house through handholes, the amount of wire thus used is only the exact length to reach the precise point aimed for. The remaining wires in that cable, terminating at that particular manhole, can again be spliced to a cable of an equal number of conductors to those left in that particular cable, and from thence carried in some of the lower ducts to another manhole at any distance therefrom, and in a like manner distributed from block to block until the capacity of the cable be exhausted. By this means no dead wires are left.

The carrying capacity of a conduit system, of course, is regulated according to the street in which it is laid, and to provide distribution for the opposite side of the street in which a trunk line of conduit may be laid, which might be of sufficient capacity to provide for the great possible increase of wire service in the future, would nevertheless have its distributing system on the top as in all other cases; but in case of the street being so wide as to make it impracticable to cross the street to make direct house connections to the houses on the opposite side of the street, the Johnstone system provides similarly constructed conduit to the one described, but of a diminutive size, provided with all the handhole conveniences and only of a sufficient capacity to supply the demand for the buildings on that particular side of the street solely. This subsidiary conduit could be thus extended around all four sides of a block, that entire block being provided with electrical service of all kinds fed out of the manhole at the opposite corner in the trunk line system from which the subsidiary line started. In the suburban or sparsely residence portion of the city where but a small amount of electrical service will ever be required, a modified form of this system has been devised and completed, and embraces in one conduit structure facilities for separate and distinct electric light service, also telephone, telegraph, burglar, fire and messenger service, the system being fully complete for an independent distribution for each one of these operations, permitting from a commercial standpoint, a complete system throughout the entire city in outlying and sparsely populated districts.

We have described this prominent and thoroughly worked out system at much length, and the readers of the ELECTRICAL REVIEW will, we are sure, appreciate the work required on our part in getting all these points and properly presenting and graphically illustrating them.

—— The Missouri Electric Light and Power Company, of St. Louis, recently organized to operate the Westinghouse system of incandescent lighting, has bought the property at Twentieth street, facing 169 feet on Locust, for a central station, having a capacity of 50,000 lights. The station will operate day and night, and lights will be furnished to business houses and office buildings by meter, at prices to compete with gas, affording the public reliable service at low rates.

Meeting of Electric Light Men.

The National Electric Light Association meets at Chicago, in the Exposition Building, on the 19th, 20th and 21st instants, and, from what can be learned, is likely to be more than usually interesting. There will be at the same time a large exhibit of electrical and kindred apparatus, the most interesting of all, perhaps a 900 foot track, with curves of 90 feet radii, on which it is expected the various types of electric motors will be tried. The principal magnet—we speak figuratively—to attract the electrical men will be the papers to be read and the discussions following them; notably, "Current Meters," "Static Charge in the Puncturing of Underground Cables," Relation of the Material of Conduits to the Insulation of Cables."

These discussions are unique in their way and, perhaps, it is not going too far to say that the manner of conducting them is quite as novel as the apparatus which is their inciting cause. At the meeting of scientific associations—there are exceptions, of course—one must needs listen to much which, though often good and sometimes true, is not always new, and again to what is new, but neither instructive nor entertaining; for, as in a society of artists, there is the old academician, who is *hors concours*, and whose pictures must be accepted and hung "below the line," whether good or bad, so in the long established scientific association there are those who have the right to talk, to occupy the time of a meeting, whether or no they have any information to impart. But, in the electrical field of to-day, apparatus and methods change so quickly that a new device or idea is scarcely arrived when that which is still more novel is treading upon its heels.

The electrical men come from all parts of the country at stated intervals to compare notes concerning these; it being a vital importance, and by no means an easy task, to keep abreast of all that is going on in a particular line. There is no time for idle talk, for oratory, for ancient history, for dessertations on things in general, with an occasional remark on the subject under discussion. The chairman has no traditions to follow, and no mercy; the committee to whom all papers must be submitted, rarely pass one that does not treat of a live issue. When it is remembered that many of the best practical minds of the country gather at these conventions, and that in their line they are, it is conceded, leading the world, it is not, perhaps, going too far to say that to attend these conventions is to get a liberal education in applied electrics.—*Scientific American.*

Magnetic Images Produced by Feebly Magnetic Bodies.

If iron filings are shaken on to a very thin piece of sheet iron placed on the poles of a magnet, the particles arrange themselves along the lines of force. But quite a different result is produced by shaking very carefully on to the sheet of iron sesquioxide of iron, iron scales from forgings—which are a mixture of ferrous and ferric oxides—and the various oxides of nickel and cobalt, all in a state of very fine powder. Instead of using dry powders, the oxides may be suspended in a varnish of lac dissolved in alcohol, which on drying preserves permanently the image formed. The powder accumulates in considerable heaps corresponding to the edges of the poles of the magnet, and above the intermediate space it arranges itself in lines or threads, the formation of which is facilitated by tapping the sheet of iron. These threads do not arrange themselves along the lines of force as do iron filings, but at right angles to them, or, in other words, they map out the equipotential lines. No results have been obtained with diamagnetic powders, using the strongest magnets at the author's disposal.

A double effect is produced with magnetic oxide of iron in fine powder, and with iron, nickel, and cobalt reduced by hydrogen to the metallic state. There is a double system of interlaced threads, the one following the lines of force, and the other the equipotential lines. This double system can be most readily obtained with the solution of lac.

The phenomenon is no longer observed if too thick a sheet of iron is used, nor if the iron sheet is replaced by one of a non-magnetic metal such as copper or zinc.

The author explains the phenomenon by the property, possessed by all lines of force, of tending to shorten themselves. The curved threads of powder formed along the lines of force tend to shorten themselves, and to approach the position of maximum intensity, where they would lie in a straight line from one pole to the other. But this tendency is opposed by the attraction of the neighboring particles which are magnetized, and by friction on the surface of the iron sheet; in the case of feebly magnetic bodies this latter force is the more powerful, and the particles, in moving to the position in which the threads will be shortest, leave a sort of trail behind them arranged along the equipotential lines, and formed of small particles of the powder heaped up one behind the other.

Chicago, Ill.—The Electro-Optic Manufacturing Company, at Chicago; capital stock, $10,000; for the manufacture of electrical, optical, chemical, medical, mathematical and mechanical goods, machines and appliances; incorporators, G. B. Reynolds, H. C. Sample, and G. D. Stout.

Nashville, Tenn.—The Pneumatic Railway Company of the United States; incorporators, Charles Walton, Charles J. Raincar, William Dreisbach, W. Durell, Shuster and Eugene M. Aaron; purposes, to manufacture iron, operate machines, motors and contrivances, for furnishing motive power by pneumatic process, or by electricity, or by the combination of electricity and the pneumatic process.

Cincinnati, O.—The Central Thomson-Houston Company, Cincinnati; capital stock, $200,000; has been incorporated to furnish electric light and power.

East St. Louis, Ill.—The Monarch Gold Mining Company, at East St. Louis; capital stock, $3,000,000; for mining gold; incorporators, A. Whipple, P. Robyn and R. L. McLaren.

Boston, Mass.—F. W. Ames and others have petitioned for incorporation as the Boston Electric Elevated Railroad Company, for rapid transit between different parts in Boston and its suburbs.

Peoria, Ill.—The Peoria Gas Specialty Company, of Peoria; capital, $104,000; for the manufacture of gas and other illuminating machines; incorporators, J. Elder, J. N. Whelpley and R. L. Lamis.

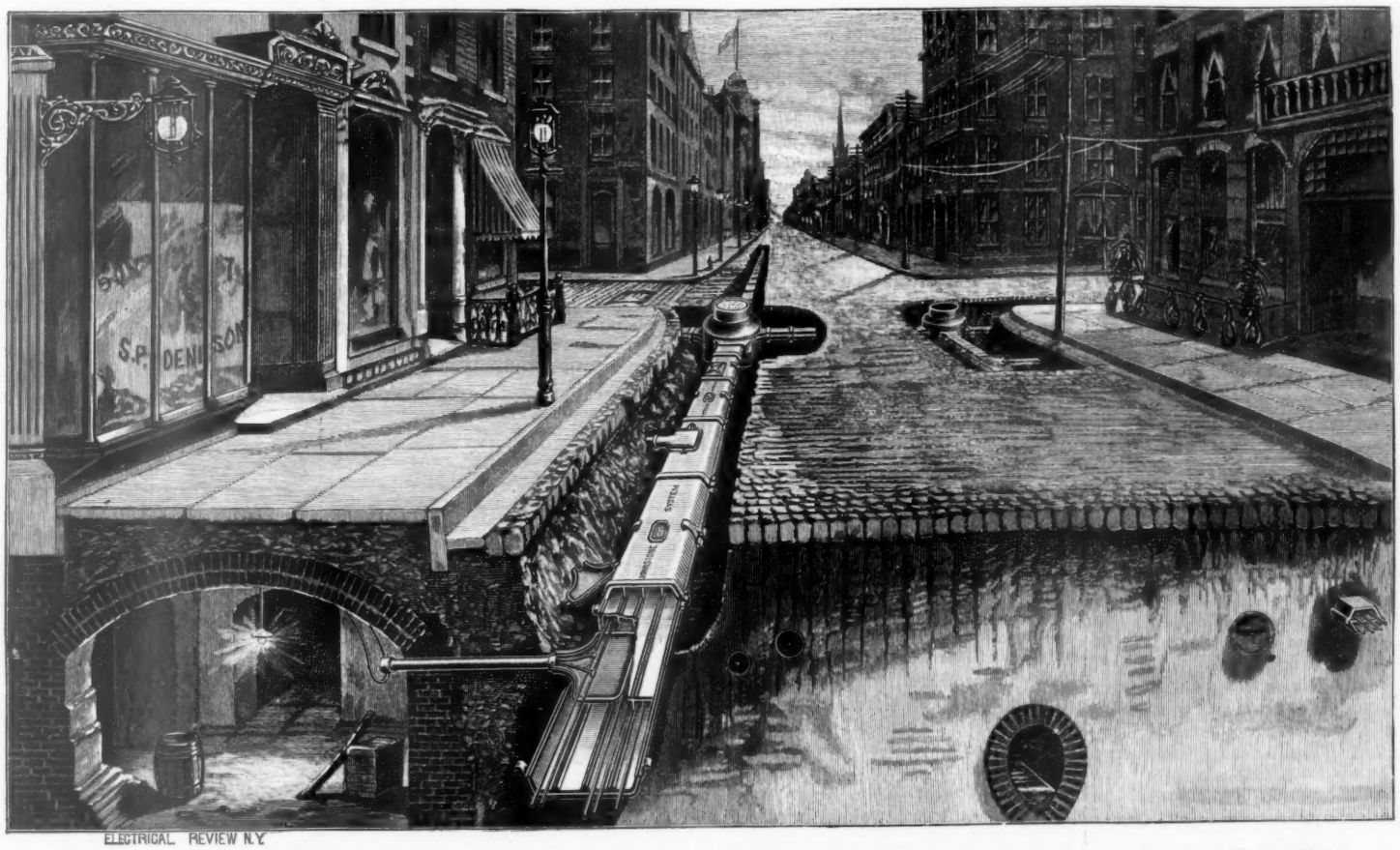

FIG. 3.—THE JOHNSTONE SYSTEM, SHOWING CONDUIT, INCLUDING TRUNK AND DISTRIBUTING DUCTS WITH SUBSIDIARY CONDUITS AND FLUSH BOX.

(See pages 6 and 7 for other Illustrations.)

Savannah, Ga.—The Savannah Electrical Company has been organized at Savannah by Herman Meyers, C. F. Prendergast and P. W. Meldrim; to operate telegraph and telephone lines; capital stock, $50,000.

Chicago, Ill.—The Interstate Rolling Stock & Construction Company, at Chicago; capital stock, $500,000; for construction and operation of railway cars of all descriptions; incorporators, W. F. Brewster, F. W. S. Bradbury and W. S. Brewster.

Turtle Creek, Pa.—Turtle Creek Gas Company, of Turtle Creek, Allegheny County; capital stock, $5,000; directors, Peter A. Boli, James Gilmore, Jr., B. A. Jobe, A. O. Tinsman, Joseph P. Johnston, William E. Evans and S. A Rath, all of Turtle Creek.

Albany, N. Y.—The Champlain Telegraph Company; to operate a line from Pittsburgh to Lake Placid, in the Adirondacks. The new line will run through Clayburgh, Chase's, Loon Lake, Paul Smith's and Saranac. It will be 100 miles long; the wires will be in operation in June next.

North Brookfield, Mass.—The North Brookfield Electric Company; capital of $15,000. The officers are: F. Batchelder, president; B. H. Smith, treasurer, and T. T. Robinson and C. A. Bowditch, directors.

Chicago, Ill.—Englewood & South Park Street Railroad Company, at Chicago; capital stock, $200,000; to construct and operate a street railroad in Cook County; incorporators, Edward O. Russell, Hilburd Dunlevy, and William H. Allen.

Camden, N. J.—The Self-Storage Electric Light and Power Company; authorized capital of $500,000, of which $1,000 is paid in; Charles R. Stevenson, of Camden, John H. Jenkins and Joseph L. Chapman, of Philadelphia, are the incorporators.

Pittsburgh, Pa.—The Ore Reduction Company, of Pittsburgh; directors, George Westinghouse, Jr., Lemuel Barrister and Samuel T. Wellman. The capital stock is $30,000, divided into 600 shares at $50 per share. The object of the company is to purchase and sell patent rights for inventions with the right to issue licenses.

ELECTRICAL REVIEW

Published at 13 Park Row

P. O. BOX 3329.

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SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance. Postage paid by publisher.
Great Britain and other foreign countries, $4.00, in advance. Postage paid by publisher.

ADVERTISING.

Transient, 25 cents per line, nonpareil.

DEALERS SUPPLIED BY
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EDITORIAL ANNOUNCEMENT

Address all communications and make all Express Money orders, P. O. orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

☞ No attention will be paid to communications without the *name and address of the writer.*

We invite correspondence from Electricians, Inventors, and the Telegragh and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, FEB. 23, 1889.

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Chicago is the Mecca of electrical workers this week. She will wear her honors proudly and most happily.

A good deal of interest attaches to the question as to the physical action of the electric current on copper wire. Several instances go to show a destructive action produced on the wire. This is a fitting subject for discussion at the Electric Light Convention, and some interesting facts may be brought out in connection with it.

The report that the recent exhibition of the American Institute cost $16,000 more than the receipts is not refreshing. Something is the matter. Other cities have industrial exhibits which outrival those held in New York, and, if we are not erroneously informed, are money-making institutions. We are not prepared to name the remedy, but it is hoped that the secret of success may be found before another attempt is made.

A topic of great interest for electric light men is the subject of electric fuel. Especially with reference to the cheap, if mephitic, petroleum produced in immense quantities in the Lima oil fields. So far, this stuff has baffled the refiners, and, do what they may, the scent of the Lima will hang round it still. But its thermo-dynamic properties also hang round it, and it is just as good for fuel purposes as though it were redolent of the most exquisite attar of roses. Let us hear from some of our Western friends who have doubtless tried the experiment.

Mr. "Ban" Corrigan, a professional hangman, living near Harlem Bridge, is much moved, it seems, over the substitution of electricity for the hempen rope in the "removal" of culprits to a happier sphere of usefulness. He says: "The rope never did them no harm" (gave them no pain), and he declares that the "mild" and "resigned" expression that usually ornaments their faces remains to the last, whether they be done to death by the "drop" or the "lift" system. It seems almost cruel to destroy the beatific picture thus drawn of the last moments of the condemned by substituting electricity, but then the current is also painless besides being instantaneous, and Mr. Corrigan may soothe h s delicate sensibilities by recalling the last words of Robespierre to his hangman: "Oh, Samson, thou canst not be too quick!"

Our electrical friends coming to New York should not fail to examine the conditions of power transmission radiating from a station in Duane street. Already a large number of steam users have put aside or sold their engines to get their power over the wires, getting rid of engineer, coaling, ashes, smoke, dust and the oil nuisance. The experience in the neighborhood has affirmed the statement made in the REVIEW some time since that, such are the benefits of electricity as a motor, that, given two rival workshops of the same kind, if one drives its shafting by electricity the other must do so or shut down, so much it cheapens the cost of production.

One of the electrical projects in the air at the present time is the problem of heating dwelling houses electrically, without the use of any very hot substance. It is claimed that wall paper can be made in such a way that the passage of currents of low electromotive force will heat it moderately warm to the touch, and thus diffuse throughout the room an agreeable temperature. This is of course theoretically possible and may even become feasible in a more improved state of the art. A source of warmth coming from the entire surface of a room would certainly be the perfection of house heating and would do much to make this so-called temperate zone of blizzard's sea blows endurable. Why may not the artificial illumination of the future be of the same nature? Recent developments are tending towards the possibility of infinite subdivision. The charm of a room illuminated with myriads of candles is one never to be forgotten, though it is one which few of the present generation have seen. We predict that the ultimate use of the glow lamp for domestic purposes will be to diminish its size and increase its number.

THE EDITOR PREFERS TO DO HIS OWN EDITING.

The Council of the Institution of Electrical Engineers in London for some mysterious reason are trying to muzzle the press. With the jealousy and secrecy of the ancient guilds, they have refused accounts of their proceedings to the English technical papers, journals of the very highest repute, both in England and all over the world. These honorable journals have sometimes had a very worthy habit of condensing the Society's proceedings, and forsooth because the Hon. John Crank-Smith, J.A.C.K.A.S.S., does not see therein his vaporous and somnolent remarks about the coefficient of strength in the green cheese element of the moon, he gets mad, and forthwith moves that the aforesaid journal is real mean, and ought to be sat on by this illustrious gathering of the electrical brains of England. Thank Heaven, this is a free country so far as the press is concerned!

THE ALTERNATING CURRENT.

No better proof could be had of the comparative harmlessness of the alternating current than was given recently in the Edison laboratory in the search for a substitute for hanging. It was shown there that a powerful current must be made to pass through sensitive portions of the brain and spinal cord and conditions arranged with studied care or else the shock received would fail of the wanted aim and be harmless. Indeed, with all the apparatus on hand, the most vital parts of the body selected, and specially dampened for contact with the electrodes, a shock was given which under the ordinary conditions, where apparatus is accidentally handled, would be quite impossible. Many and many is the time a lineman has got a shock from a 1,000 volt alternating current without injury, yet, during the investigation, as we had seen, with conditions specially arranged and all favoring, a 700 volt current could be made to kill. Here, then, we have an official record of tests made by persons having no interest in the alternating current system, showing that instead of the ordinary current being dangerous, as many supposed, a man in fair health would have to exercise pains and ingenuity to kill himself by its aid. 'Tis not enough that the would-be suicide tie one end of a rope about his neck with the other end affixed to a beam above. He must arrange to stand on something that can be readily kicked away, leaving him in the air. So, with the alternating current, save under unusual circumstances, special arrangements are required to make it fatal.

THE TELEPHONE IN CONVERSATION.

One of the facts brought out in the Trobridge divorce case recently decided at New Haven, Conn., is of peculiar interest from the fact that conversation surreptitiously heard on a telephone line was introduced as evidence in court. A husband becoming suspicious that all was not right with his domestic affairs, caused a telephone wire which ran to his house to be tapped, and a stenographer was employed to write down everything he heard. The conversations which he overheard and transcribed were introduced as evidence, and played an important part in the case. A few such incidents as this will tend to make conversation over the wire even more guarded than it commonly is at the present time. It has been justly observed that much of a man's character can be learned from the way he talks into a telephone. Who cannot remember when the telephone was put into commercial use, being sometimes addressed by an unseen, and often unknown speaker, in language such as a man would rarely use face to face with another man. Even now one can usually tell a person who has rarely used a telephone, by a certain relaxation in the common courtesies of speech. There is an impersonality connected with the act of speaking by aid of a mechanism which has been lowering in its tendencies, for it is only by the personal presence of others that many men's speech are kept in restraint. On the other hand, a man of true refinement can usually be told by the courteous and graceful languages which he uses when at the transmitter.

THE MICROBE OF THE MAGNET.

With all the paraphernalia of the modern physical and electrical laboratory, the instruments of precision that will handle a millionth of an inch as readily as a laborer his pick or shovel; with all the evolution going on through generations of scientists, and the almost incessant wresting of secrets from the bosom of nature, we doubt if science is any closer to the isolation or attenuation of the microbe of the magnet.

It is absurd to suppose that a primary energy is impressed upon a piece of hardened steel once for all. The transfer of that energy into actual work would quickly destroy the magnetic power, yet such destruction not only does not take place, but the very exercise of the power strengthens the magnet. A horseshoe of steel can be magnetized in 10 seconds by the current of a few amperes from a battery, a ridiculously small amount of energy all told, and such magnet can lift many pounds of iron in contact. But without contact, it may lift and hold a pound of iron easily. It will hold that pound for an eternity, and every second of that time without end the magnet is expending energy, until it foots up an almost inconceivable total of actual power. Not alone that, but the magnet of one pound lifting power to-day may and will be stronger to-morrow. Where does all this really tremendous amount of energy come from? By what inscrutable process does the mere magnetization of a bar of steel make of it a machine for the transformation of energy? Not a reactionary or storage device which, like a steel spring, honestly gives back approximately all it has received; but a perpetual transforming or converting machine. There is a hidden process going on of some kind, energy is going into the magnet all the time it is doing work, energy in some form. Where does it come from, gravity? atmosphere? solar rays? earth currents? Who can say? It is a great problem worthy of a lifetime of indefatigable research. It is a microbe and it will be discovered, and the discovery will make electricity the queen of nature's forces and steam will become a dim vision of the dark ages of the past.

BOOK REVIEW.

Modern Electricity.— Notwithstanding the amount continually written and published upon electricity in all its phases, outside of those whose business directly or indirectly requires them to inform themselves as to the facts of modern electrical science, it is safe to say that very few of the general public have any definite knowledge of electricity, its nature, phenomena or how it is controlled and made use of.

The little book with the above title, undertakes to explain to the non-technical reader what electricity is, its relation to magnetism, how it is produced and how utilized in the arts. It is published by De Wolfe, Fiske & Co., Boston, 1889, and prepared by Mr. Thomas Kirwan, a well known journalist, who has written many semi technical articles for the daily press of Boston and other cities. The book treats of magnetism, electromagnetism, batteries, the dynamo, electric, arc and incandescent lighting, electric welding, motors, railways, the storage battery, telegraph, telephone, microphone and phonograph, giving a brief statement of the latest information in these directions. It will assist in giving the non-technical reader a more exact knowledge of electrical science and in creating an interest which will lead the student to the more extensive treatises.

Not the least useful part of the book is a quite full glossary of electrical terms at the end of the book.

The book comprises 128 pages, 12 mo., paper, and is sold at 30 cents per copy and may be obtained at this office.

The stockholders and all others interested in the Sun Electric Co., owe a debt of gratitude to Mr. Frank Ridlon, the treasurer of the company, for his able and consciencious management of its affairs since active business ceased. The duties were onerous and many a man would have shrunk from their performance or failed in undertaking them, and it is from the very adverse conditions under which he labored that Mr. Ridlon's management is all the more praiseworthy.

CHICAGO ELECTRIFIED.

[*Continued from first page.*)

the greatest and most important electric light convention ever held in this country, which is announced by an immense sign on the Adams street entrance, 50 feet long and 10 feet high. Above this is located one of the most searching search-lights ever exhibited, the focus of which is at Dearborn street, three blocks away. It is so powerful that it casts a most positive shadow in the midst of the strong arc lights at the point of focus.

Inside of the great building all is bustle and hurry—nearly everything used and connected with the subtle force in the way of light or power invented up to date, will be exhibited.

Mr. B. E. Sunny, chairman of the Executive Committee, and his associates, must be more than electrical men, for they must have used some magnetic force with the Exposition managers in having the building renovated so as to make a winter convention agreeable and inviting. Many winter conventions have been held here, but this is the first one where steam heat and many other conveniences will make it inviting to all who are interested, and desire to study the applications of electricity for light and power.

The space is divided into departments A and B, main floor, and engine rooms. In department A are located all moving exhibits, while in department B are still exhibits. The engine rooms are in the north part of the main floor. Many exhibitors who were either too late to get within the sacred precincts of the art rooms—where the principal exhibits are located—or required larger space than could be allotted there, have contented themselves with the main floor, outside of the cheering influence of steam heat.

Perhaps the head and front of an article on this exhibition should be the R. R. motor. There will be five of these on exhibition, and three of these of different systems will be placed in actual service on the railway, which has been laid on the floor of the main hall, some 400 or 500 feet. There will be hundreds of even the electrical fraternity, who will be surprised at the vast improvements in the both motors and electric lighting, which will be brought to the surface at Chicago. 200 arc lamps of many varities will compete for supremacy with 3,000 glow lamps.

The exhibitors rooms are close and adjacent to the assembly rooms. Directly off this latter is the press room, where the various electrical papers will have their headquarters. The audience room will seat nearly or quite 500 comfortably. Cloak rooms, toilet and exhibitors rooms are warmed as well as heated, so that such a thing as discomfort will be almost utterly impossible.

The exhibits of wire, in every form, size and quality will be far more extensive than has ever been gathered together. Storage batteries will claim much attention. The press room entrance is in the direct line of approach to the assembly—in other words, as you enter the former you will find the REVIEW at your right. You enter from the north and pass into the convention hall through the west door of the press room, directly in front of the REVIEW.

Belting, too, will come in for a share of the visitors' time. There will be tanned and rawhide, link and solid, and the exhibitor will advance abundance of reasons, give why and wherefore for the belief that is in him.

An indefatigable worker is Mr. F. N. Bosson, who has been representing the Executive Committee, and has been on hand early and late at the Exposition Building, hard at work, always the same genial good-natured gentleman, with a kind word or a helping hand for all.

Among the special new features of the Convention will be the exhibition of the phonograph; Mr. Sunny, Chairman of the Executive Committee, tells me it will be exhibited in the Convention Hall, every evening. An audience of 400 can have this wonder explained at one seance. These then will be dismissed and the room again filled, and so on during each of the three evenings. This can easily be done because it is expected that the meetings of the Association will be all held during the day time. This will give the evenings to exhibitors, phonograph, etc. From present indications the phonograph exhibition will be highly appreciated by all in attendance at the evening gatherings.

The rush for space at the last moment is gathering strength like a gathering storm. Over 30 applications have been made by new-comers for space in the last 48 hours, and the 25,000 and odd square feet of the main hall, which was not originally counted on, will be crowded with exhibits. But Mr. Bosson guarantees space for all. None have yet been turned away who come in good faith to ask space. Some trouble has been experienced by Eastern exhibitors in locating and getting their consignments into the building, but as Sunday will be no day of rest for the Convention people, these will all be placed and ready in time for the opening. Monday night the Chicago Electric Club will hold a general jollification meeting, and it is presumed that the boys will be very generally present.

The following is an accurate and complete list of exhibits as can be obtained up to this time.

DEPARTMENT A.

Electrical Supply Company, Sperry Electrical Light Company, National Electric Manufacturing Company, Woodward Electrical Company, Thomson-Houston Electrical Company, C. & C. Motor Company, Chalmers Spence Company, Detroit Electrical Works, E. P. Gleason and Company, Knapp Electrical Works, New York Insulated Wire Company, American Electrical Works, Kesler Electric Company, John A. Roeblings Sons, Charles A. Schieren and Company, Belding Motor Company, Callendar Insulating and Water Proofing Company, Eddy Electric Manufacturing Company.

DEPARTMENT B.

Okonite Company, Central Electrical Company, Wykoff Pipe Company, Phoenix Glass Company, Chicago Rawhide Company, Munson and Company, W. B. Cleveland, Water Sweeney Company, H. W. Johns, Union Brass Company, Reliance Gauge Com-Company, Standard Underground Cable Company, American Walthan Watch Company, Lakes Conduit, Non-Magnetic Watch Company, Schultz Belting Company, D. C. Hood.

The following exhibits are already in place: Knapp Electrical Works, of Chicago; a full line of goods manufactured by the New York Insulated Wire Company; Grimshaw white core wires and cables, insulating tapes and compounds, switch board cables, braided wires, duplex fixture cords, and line wires, all sizes; Central Electric Co., of Chicago and Kansas City; Okonite wires and cables, Candee weather proof line wire, Manson tape, Okonite tape, Cleveland arc and incandescent switch, Butler Hard Rubber company's sheet, rod and tube, construction tools, incandescent and Stoddard cut-out, and numerous other electrical goods.

Mr. Geo. C. Bailey, Chicago manager of John A. Roeblings' Sons Company, 171–173 Lake street, exhibit in space No. 7, main hall.

These wires are made of Lake Superior copper, 97 per cent. pure and are used largely throughout the country by electric railroads for overhead wires, because their long lengths as they are drawn (drawn to five miles), under the Belgian process from ingot of 175 to 210 pounds weight. They exhibit samples of this hard drawn copper wire. They also exhibit a varied line of insulated wires including sub-marine, armoured and unarmoured cables, also a special line of aerial wires.

The Electrical Supply Company exhibits an automatic pole lighting arrester, an adjustable independent support arc lamp hanger, guards for cross arms to prevent falling wires, tree insulators which permit the swaying of limbs without danger to the wire, measuring and testing apparatus, double pole cut outs with a peculiar attachment by which a secondary fuse is arranged to show whether a trouble is temporary or permanent, also the Cobb vulcanite wires.

Mr. A. H. Patterson of the Phœnix Glass Co. is here. This well-known company has certainly made their exhibit the most artistic feature of the Exhibition, their space having the form of a crescent, decorated in neat contrasting colors, which displayed to advantage the beautiful aggregation of their efforts in glassware. There was an arc globe of every known system, which showed their merits in the regularity of shape and quality of glass, being free from imperfections of any kind. But the climax was reached, one would think, in their line of incandescent globes, so extensive in its variety and beauty as to receive compliments of admiration from every visitor. A well-known citizen of Chicago, noted for his artistic taste, was overheard to exclaim—"This is *the* art feature of electric lighting, and nowhere has its possibilities for decorative effect ever been shown as here." They had hundreds of globes in many soft and mellow tints, such as rose, canary, blue, opalescent, amber, etc., and specially fine effects in combinations of rich cut crystal and blending colors—in fact, embracing from the ordinary opal and etched, to the most beautiful effect in rich cut crystal, suitable for homes of the wealthy and refined. Their *chef d'ouvre* was a large bowl shaped globe, fourteen inches in diameter, of the finest rich cut crystal glass, "Phœnix" cutting, which, when lighted, rivalled the brilliancy and prismatic effect of a diamond.

Phœnix Glass Company have made it their aim to keep in advance—believing in the future of electric lighting—and their exhibit proves conclusively that their efforts have been in the right direction, and produced, already, gratifying results. Some few pieces of their justly celebrated rich-cut crystal tableware was shown—salad bowls, tankards, finger bowls, etc.—which also received high praise.

It is to the interest of every one to see the wares of this company, and a visit either to their handsome store, 729 Broadway, New York City, or their office in Pittsburgh, Pa., will be both pleasant and instructive.

From present appearances the entire 100,000 tickets will be both issued and used.

Chicago, Feb. 16, 1889. C. C. H.

THE ELEGANT SPECIAL TRAIN FOR THE CONVENTION.

A special vestibule-train chartered from the Pennsylvania Railroad, lighted by electricity and fitted up in grand style, left Jersey City Sunday morning with 46 delegates from New York and vicinity to the National Electric Light Association Convention. Several more delegates were picked up at Philadelphia, Harrisburg and Pittsburg. The cars were entirely new throughout. It comprised three Pullman vesibule cars, a dining car and a combination car, the latter including a bath room and barber shop. The drawing room cars were furnished with large easy chairs, upholstered in handsome style, a library, writing desks, and a sideboard. It was the finest special train which has ever been sent out of New York.

Following is a list of the delegates from New York: John F. Haskins, C.O. Baker, Jr., C. A. Scherien, J. P. McQuaide, H. D. Stanley, W. J. Morrison, B. R. Weston, A. Conkling, E. F. Gennert, H. W. Pope, G. M. Phelps, M. Abdank, W. H. Johnstone, Clarence W. Mead, D. Chalmers, H. M. Haines, Charles Cooper, James L. Jensen, S. J. Simmons, J. F. Halcy, C. E. Stump, Joseph Wetzler, U. H. W. Schenck, A. P. Nazro, C. R. Botsford, George S. Barnum, E. F. Peck, D. Liesenring, C. W. Price, P. C. Ackerman, A. D. Newton, C. E. Newton, E. B. Hatch, E. L. Burrell, J. C. Pierrez, A. C. Shaw, T. H. Brady, George F. Porter, A. F. Stanley, I. H. Davis, D. C. Hood, J. B. Edson, J. B. Ecclesine, John R. Gery, E. T. Gilliland, F. R. Colvin, T. W. Sprague, C. Y. Wheeler, Albert Hayden, C. G. Young; and from Philadelphia: W. H. Temple, H. S. Skillman, H. A. Cleverly, M. D. Law, R. O. Heinrich, T. C. Smith, C. O. Hering, Mr. Moss and Mr. Bornouville.

The Edison Electric Light Convention at Kansas City.

The gathering of representatives of the Edison companies at Kansas City last week, was by far the largest and most interesting of any of these conventions yet held, and a report of the proceedings and all matter of interest connected with it will appear in the next edition of the REVIEW, as it came too late to give it the extended notice it deserves this week.

General Western Notes.

The telephone dissatisfaction fever, which has become epidemic, has reached old Mexico. A committee of merchants at the Capitol City are soliciting subscriptions for a new telephone company, the Mexican Telephone Company being accused of rendering imperfect and unsatisfactory service.

Lincoln, Neb., was left in an unpleasant predicament on the 5th instant. At 3 P. M. two of the boilers in the State Hospital for the Insane exploded, destroying the entire battery of boilers and the dynamo. The asylum was left without heat, without electric light, and without the means of preparing food. Two patients were killed, the engineers were not expected to recover, and a couple of other parties were wounded seriously. Imagine a lunatic asylum in darkness.

Messrs. E. P. Allis & Company, manufacturers of Allis-Corliss engines, recently erected the first electric crane in this country. It weighs about 30 tons, and is capable of lifting and carrying to any part of the foundry a weight of 25 tons, with ease. It is shaped something like a bridge, which is suspended on tracks built near the ceiling. It has three electric motors. One moves the crane along the track, one moves the carriage at right angles to the last named direction, the third does the lifting by proper mechanical appliances and combinations. It is working perfectly in every respect.

A bill was introduced in the House at Springfield the other day, providing in substance that any horse and dummy or tramway, duly organized, may use electricity or cable in lieu of animal power under the supervision of proper officials of towns, cities, or villages where such road is run.

An increase of appropriation is asked for the Fire Department, for the year, of about $600,000. The estimates for several districts of the city, which the city fathers desire to have lighted by electricity, readily make up the increase. Prof. Barrett's figures are as follows:

In the south division, bounded by Twelfth street, the lake and the river	$143,170
In the north division, Clark to Centre, State to Division, Wells to Clark, parts of Chicago avenue, North avenue, Centre street, Clyburn avenue, and Division, and the plant which will be installed at the North Side Water Works	149,170
In the west division, Milwaukee avenue to North avenue, thence to Robey, along Division to Robey, Chicago avenue to Ashland avenue, and Noble street between Fourth and Indiana streets	112,770
Parts of Blue Island avenue, Harrison and Van Buren streets	71,170
Archer avenue, from State street to Pitney avenue	52,250
	$528,530

The telephone bills of Representative Baker and Senator Eckhart, of Cook County, introduced into the Legislature of Illinois, "regulates" as follows: It permits a rate of rental for cities of 60,000 or more inhabitants, $6 per month. Between that figure and 25,000, $4 per month, and in all places of less than 25,000 inhabitants, and in all other places, $3 per month.

Between two cities or villages connected by wire, the use of a telephone shall not be charged for in excess of 15 cents for the first five minutes, and for each additional five minutes not more than five cents shall be charged—but no charge shall be made for service when furnished to regular rentors of telephones in either of the places so connected by wire.

Section 2 sends a chill through one's body; its right resting on the beach of the lake, and its line of march being parallel and close to the backbone of the stockholder. It provides that "any individual, firm, or corporation, operator, agent, or other person, who shall charge, collect, or receive for the use of any telephone, any sum in excess of the rate fixed by this act, shall be deemed guilty of a misdemeanor, and shall, upon conviction thereof, be fined $200 to $500 for the first, $500 to $1,000 for the second, and $1,000 to $5,000 for the third offense; and after that he shall be liable for each subsequent offense to a fine of $10,000." A persistent and well directed effort on the part of an individual, company, or corporation in the direction of transgression, would speedily help the school fund of the State, for all these little reminders prepared for transgressors drop into that collection basket.

The town of Lake, adjoining Chicago on the south, has just opened up a new electric light plant, and is brilliantly illuminated. The social bats and owls are fleeing from former haunts, and the law-abiding citizens are rejoicing at the improved condition which the authorities have inaugurated. C. C. H.

Telephonic News

*** A telephone rate fight is being carried on in Missouri. A bill is before the Legislature reducing the telephone rates.

*** A new 50-wire switchboard is being added to the Los Angeles Telephone Exchange to accommodate the increase in the list of subscribers. An exchange has been opened at Ventura, which will be made headquarters for all lines in Ventura county.

*** Superintendent Donaldson, of the Johnstown, Pa., telephone exchange, is looking for a route over which to extend the line westward. It will take in Nineveh, New Florence, Lockport, Bolivar, Blairsville, Latrope and Greensburg, which will unite Johnstown with Pittsburgh.

*** The stockholders of the Bell Telephone Company, says a Boston exchange, are promised another nice little plum in the shape of an option to take new stock at par in order to provide the necessary funds for addition to the long distance plant. The amount to be issued is reported to be $10,000,000.

*** The Chattanooga, Tenn., Telephone Exchange has adopted a plan to overcome the telephone buzzing after the electric lights are in use. It is to use a return or ground wire of copper, much larger than that of galvanized iron, to which the 'phones are connected. The management is doing all in its power to give Chattanooga a perfect service.

*** The Boston *Journal* says: A gentleman whom we have found always well posted upon telephone matters says that the Bell Company proposes to expend $10,000,000 additional before the expiration of its patent and contract with the Western Union in 1893, and that at that time the company will have the finest telephone and telegraph system in the world.

*** A committee of merchants in the city of Mexico is soliciting subscriptions for a new telephone company which it has been decided to establish, owing to dissatisfaction with the service of the Mexican Telephone Company. The press is attacking Haller's concession in Lower California, trying to prove that it is illegal and compel the government to proceed against the company.

*** The following statement from Lowell, Mass., of the earnings of the Erie Telephone Company for the quarter ending December 31, has been issued by the directors: Gross earnings, $175,039.34; gross expenses, $122,563.77; net earnings, $52,475.57; construction, $10,564.06; earnings above disbursements, $41,911.51; subscribers added, 126; total number January 1, 1889, 11,156.

*** Judge Blodgett, of Illinois, has made a ruling reaffirming his decision of several weeks ago, in the case of the American Bell Telephone Company *vs.* the Cushman Telephone Company, for damages for infringement of patents, the judgment being one cent and costs for the plaintiffs. An appeal was allowed, and the case is now transferred to the United States Supreme Court for final adjudication.

*** Bell telephone stock is strong as the result of the company's application to the Massachusetts Legislature for permission to increase its capital stock from $10,000,000 to $20,000,000 in order to develop its long distance plants. Judge Wallace, in giving his decision last Tuesday in the case of the Bell Telephone Company against the Wallace Electric Telephone Company for infringement of patent, said in effect: "That nothing can prevail against the Bell patent, according to the decisions of the Supreme Court, unless something new is brought out in regard to the state of the art of communication previous to the Bell patent."

*** Representative Baker and Senator Eckhart, of the Illinois Legislature, say they are not going to be unreasonable in opposing amendments to the telephone bill, and if the majority desire that the rates for cities over 50,000 shall be $7 instead of $6, as provided in their bill, they will accept it without demurring. But, while they are contemplating legislative action, Representative Ford will introduce a bill granting city councils and boards of trustees the power to regulate telephone companies by ordinance.

*** Superintendent Kimball, of the life saving service, has about completed his plans for the establishment of a telephone service on Long Island Sound in connection with the service now in operation in New Jersey. He is also at work constructing telephone lines along the coast. The coasts of North and South Carolina are now nearly connected by wire. He intends before another year rolls around to have the entire Atlantic coast in telephonic communication. The great point made with the use of the instrument is that the guards will have to report at regular intervals through the telephones, thus assuring the officers in charge of them that they are doing faithful patrol duty.

*** As will be seen by the following letter from J. E. Hockett, district superintendent of the Central Union Telephone Company, the toll system in operation between LaPorte and the Harbor City will have to be closed up. The letter reads as follows: "Yours of the 22d inst. relating to LaPorte and saying that parties there would like to arrange to connect the telephones to be rented for private lines with each other, and having exchange service, and to use their lines as a fire alarm, is received. Under a decision of the supreme court rendered yesterday in one of our cases I can say definitely that there is no prospects of our being able to make such arrangements unless the telephone rate law is repealed; and while, as I understand it, the decision is not that our toll system is a violation of the law, we are liable to such suits, costs and expenses where we have central or exchange stations and decline to rent telephones; that it is very probable, unless the law is repealed, we will have to close up the local toll system we have in operation. J. E. Hockett, Supt."

Extract from Sir William Thomson's Presidential Address—"Electricity, Ether and Ponderable Matter."

The telephone, one of the added subjects of the Institution of which we are members, illustrates very splendidly these developments of the theory of the transmission of signals through the submarine cable. The telephonic signals have, in fact, sufficient frequency to make electro-magnetic induction very sensibly influential. The frequencies in telephony correspond to from 250 periods per second up to two, or three, or four times that; being the frequencies involved in speaking in the human voice—tenor and soprano—and in the quality of the voice as affected by the over-tones. I say frequencies of from 250 per second to 1,000 or 1,500 periods per second are concerned in the fundamental notes, and in the characterizing over-tones, of the sounds transmitted by the telephone. Now, there seems no doubt but that the clearness of the telephone through great distances is to a large degree due to the circumstance which Heaviside has pointed out—that we have much less of difference of attenuation and difference of phasal retardation, for different notes, with the actual frequencies of the notes in sounds transmitted through the telephone wire and the practical dimensions of the telephone wire, than we should have without electro-magnetic induction (hear, hear).

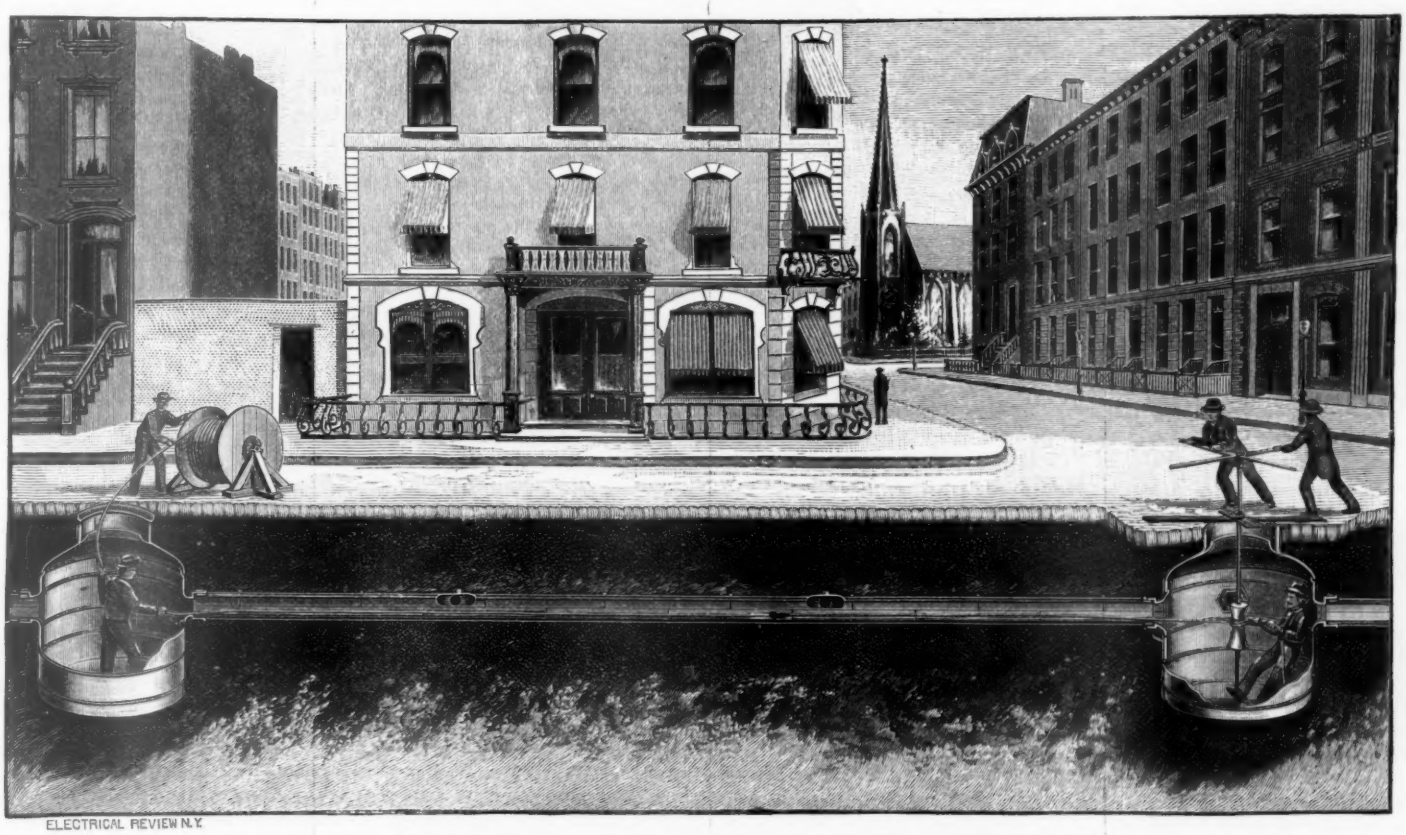
I cannot speak on this subject without just touching upon a question which I do not at all propose to enter upon to-night, and that is, the relative efficiencies of iron and copper as telephonic conductors. Information given to me by Mr. Bennett, the engineer of the National Telephone Company in Scotland, leaves no doubt whatever but that there is a very considerably greater loss of clearness in speaking through an iron wire—such, for instance, as the first metallic circuit iron wire of the Post Office between Glasgow and Edinburgh—than there is speaking through the present copper wire circuit of the company between the same stations. I shall say nothing more of this just now. It is an exceedingly difficult and complicated subject. But Heaviside's mathematical work, and Lord Rayleigh's experimental investigations on the susceptibility of iron to very small differences of magnetic force, differences of magnetic force superimposed to even a powerful magetic force or a large residual magnetism, put us, I think, in a very hopeful condition. The subject is in good hands, mathematical and practical, and I think before many months pass over the Institution of Electrical Engineers we may have an absolutely clear understanding of telephony through iron wire as compared with telephony through copper wire (applause).

Leaving all questions of submarine telegraphy, and of telegraphy or telephony, in which, whether from the greatness of the distance through which the communications are made or smallness of distance between insulated conductor and sheath, or between the twin wires when insulated metallic circuit is used, the effects of electro-static capacity give rise to sensible difference of strength of current in different parts along the length of the conductor, I wish to call your attention to the differences of current density across different parts of the cross section which are produced when alternate currents are sent through a wire. Consider a copper wire and a copper tube surrounding it for return. Or consider what is, after all, one of the very simplest cases, two parallel copper wires. If the distance between them is a large multiple of the diameter of each, as is the case in practical telegraphy and telephony, the problem is the same as the problem of a single copper wire in the centre of a cylindrical tube of infinitely conductive metal, and of radius equal to the distance between the wires. The distribution of current within the solid conductor depends only on the period of the alternations, and on the diameter and the specific resistance of the metal; and is quite independent of the surroundings, provided only they be symmetrical all round, or provided, if the case be that of two parallel wires, the distance between the two wires be a large multiple of the diameter of each, so that the current in each is not sensibly disturbed by the influence of the other from being arranged in co-axial cylindric layers of equal current density. For this problem the mathematical theory gives us a remarkably interesting and very useful practical result, and I really, in proposing to speak upon such a very abstruse

FIG. 4.—THE JOHNSTONE SYSTEM CONTINUED.—INTERSECTION OF TWENTY-THIRD STREET AND FIFTH AVENUE, NEW YORK, SHOWING ITS ADAPTATION TO SYSTEMS PREVIOUSLY LAID FOR THE DISTRIBUTION OF CONDUCTORS, AND ITS CONNECTION WITH BRICK-MANHOLES.

and uninteresting subject as electricity, ether, and ponderable matter, wish to try to give one little piece of practical information to-night. It will be no information to some, but it may be information to others (hear, hear). The solution, expressed in a formula, and a table of numerical results calculated from it, I hope, will appear complete in the report of this address. I think I might give you just now two or three of the numbers that are rather interesting. Take 80 periods per second as the frequency—that is about what is adopted in the alternate current system of distribution for electric light: at all events in one great system I know, the Grosvenor Gallery installation, that is the frequency of the period; I believe it is pretty much the same generally. Let us take, then, as an example, the 80 periods per second. First, consider copper wire of one centimetre diameter; the ohmic effective resistance is greater than for steady current through the same wire, but not as much as one one-hundredth per cent. greater. Take, now, copper wire of one and one-half centimetres diameter; the ohmic effective resistance is two and one-half per cent. greater than the resistance for steady current. Next, take copper wire of two centimetres to the circumference, and therefore in simple proportion to the diameter. This very imperfect explanation of the results may give some idea which, I think, is of rather an interesting and important kind, but the figures will speak for themselves (hear, hear). With quadruple frequency the same figures apply to wires of half diameter. There we get the telephone problem. Four times 80 is 320, which is among the frequencies for telephonic notes; and for the 320 frequency, take the figures I have given, but with half the linear magnitudes. Thus, for instance, for copper wire of one centimetre diameter, transmitting musical notes of 320 periods per second, the ohmic resistance is eight per cent. greater than the resistance for steady currents. For a copper wire of two centimetres diameter, and frequency of musical note 320 per second, the ohmic resistance is 68 per cent. greater than the resistance for steady currents, and so on.

Another important development from this theory is that there is much less importance in the conductivity of the metal for telephonic work through extreme distance, than for ordinary electric work. The formula and figures showing the kind of relations between ohmic effective resistances for different through a conductor such as copper, and the distribution of the motion of water in a viscous fluid disturbed by periodical tangential motions of its surface, follow identically the same law. Mr. Heaviside, referring to this, has well said that this analogy is very useful, because we can see the motions in a viscous fluid and understand them, and picture them to our minds, while it is much more difficult to fancy we see the distribution of electric current in a wire. Take, now, definitively this analogy for the distribution of electric current in a round copper wire through which alternate currents of electricity are sent. Take a viscous fluid in a tube in place of the conductor, move the tube to and fro with a regular alternating motion—a simple harmonic motion. In order that we may fulfil at all approximately what I am speaking of, the length of the tube must be very great in comparison with the diameter, and the place in which we consider the motion of the fluid must be at a distance of many diameters from the ends which we may suppose to be closed by frictionless pistons, limiting the fluid at its two ends. In the first place, if the fluid were not viscous, if it was perfectly liquid, you might move the tube to and fro; but the fluid inside of it would remain at rest. Water, however, would move; oil would move; the more viscous the fluid is the more liable it would be to experience motion in that way. Now, there is a perfect analogy between the alternating motion of the fluid transmitted inwards from the surface and the distribution of the electric current in a wire through which the effect of the alternating current machine is being conveyed.



ELECTRICAL REVIEW N.Y.

FIG. 5.—THE JOHNSTONE SYSTEM.—SECTIONAL VIEW OF CONDUIT AND MANHOLES AS LAID IN 125TH STREET, NEW YORK, SHOWING THE OPERATION OF DRAWING A CABLE IN POSITION.

diameter; the ohmic resistance is eight per cent. more for the alternating current than for the steady current. In round copper rod of four centimetres diameter the ohmic resistance is 68 per cent. more for the 80 periods per second alternate currents than for steady currents. In round copper bar of 10 centimetres diameter the ohmic resistance is 3.8 times what it would be for the steady current. In a solid copper cylinder of 100 centimetres diameter the ohmic resistance is 35 times greater than for steady currents. From 10 centimetres diameter upwards the ohmic effective conductance—that is, the reciprocal of the ohmic effective resistance—increases scarcely more than as the diameter simply, and not as the square of the diameter. The conductance for steady currents is as the square of the diameter all through. The effective conductance for alternate currents follows a law which can only be expressed by aid of Fourier-Bessel functions till we get to very great diameters. When we get to so great a diameter that the shell, or outer portion, of the wire into which the current is practically confined is moderate or small in proportion to the diameter of the wire, then, for diameters exceeding that, you can all see perfectly without calculation that the conductance is in simple proportion

ferent speeds are, as we have seen, a little complicated; but I will only say that ultimately it is the square root of the resistance that we have to deal with instead of the simple resistance. Quadruple resistance is only twice as bad, speaking roughly, when the frequency is so great as to cause the effect of the ohmic resistance to be very much greater than the resistance for steady currents. The moral of this is, not that you may choose wire of bad conductivity; on the contrary, take the best conductivity you can get, whether for telephones or for electric light conductors, but shape the conductors so that the ohmic resistance shall not be too much augmented by the unequal distribution of the current.

In respect to electric magnetic theory. We have a very fine analogy with viscous fluid motion which has been obvious, more or less, from the time the known laws of electro-magnetic induction were put into formulæ in the beautiful manner in which Maxwell put them—we have a very fine analogy, I say, with the diffusion of laminar motion into a viscous fluid and its analogue in the diffusion of heat by conduction through a solid, first pointed out by Prof. Stokes (applause). The actions concerned in the distribution of alternating electric cur-

TELEGRAPHIC

.... The South Florida Telegraph Company has made a reduction in rates to all important points. The Western Union has also reduced its rates in the State about 20 per cent. to important stations.

.... The new cable for South American business being laid by the Mexican Telegraph Company will be about 1,000 miles in length, extending from Galveston to Coatzacoalcos, 200 miles below Vera Cruz.

.... The latest accession to the property of the Western Union Telepraph Company, is the Atchison, Topeka and Santa Fe Telegraph system. The Atchison and Santa Fe system had a total of 7,374 miles.

.... The new through line of the Western Union Telegraph Company was completed into Sanford, Fla. It makes only two stops between there and Jacksonville, Palatka and St. Augustine. At Jacksonville it connects with the Copper line to New York.

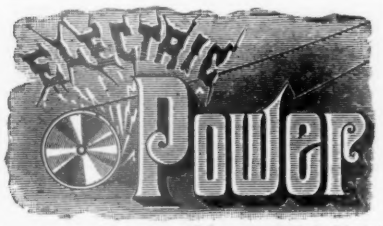
.... In the State Circuit Court at Mobile, Ala., a judgment was rendered against the Western Union Telegraph Company for $700 in favor of Louis Henderson, a colored man, of St. Elmo, Ala., for failure of the company to deliver a telegram sent to Grand Bay for a physician for his wife. The cause of action occurred two years ago.

.... The Western Union telegraph rooms in the top story of the Omaha (Nebraska) National bank building have almost been completed, and will be ready for occupancy in about three weeks. There is now a force of 90 operators, and it is expected that it will be somewhat increased when the new rooms are opened. Altogether the Western Union gives employment to 161 people in this city.

.... The fourth annual ball of the Telegraphers' Mutual Aid and Literary Association, of Boston, in Odd Fellows' Hall, was enjoyed by a very large company. Ex-President Eugene J. O'Connor was presented with an elegant gold watch as a surprise. The society has about 150 members. Its officers are: President, Robert E. Tobin; vice president, Matthew C. Harrington; recording secretary, George H. Winston; financial secretary, John A. Kenna; treasurer, Hugh W. Gillespie; sergeant-at-arms, Daniel Carter.

.... South Omaha, Neb., is to have a new fire alarm system. A contract has been drawn up and signed between the city of South Omaha and the Interstate Fire Alarm Company, by which the latter agrees to put in the complete Richmond non-interfering fire alarm system inside of 90 days, from February 6th.

.... George Cole, for many years manager of the Western Union Company, at Columbus, Ohio, has tendered his resignation. He is one of the principal stockholders in the American District Company, and resigned in order to become its manager, and will devote his time to its business interests. He had been with the Western Union about 23 years.



* * Waterville, Me., is to have an electric street railroad.

* * Milwaukee, Wis., has electric cars on the Woodward storage battery system.

* * Lake Winola, near Tonawanda, Pa., is to have an electric railway next summer.

* * Kalamazoo street car men are said to be seriously considering the question of operating their cars by electricity.

* * An electric road will soon be put in operation on Second avenue, Pittsburgh, Pa., the storage battery system being used.

* * The proposition of Leo Daft to establish an electric railway at Plainfield, N. J., was reported favorably to the common council.

* * The Cincinnati Incline Plane Co. desires to make an electric road of its Main street line and extend it to the Fair Grounds at Carthage.

* * The *San Francisco Report*, after publishing a correspondent's letter criticising electric roads, comes out strongly editorially in their favor.

* * The New York Locomotive Works, Rome, N. Y., have a contract to build an electric locomotive for the Darling Electric Locomotive Company, of New Jersey.

* * The North Side Street Railroad Company, of Fort Worth, Texas, will build an electric railroad and equip the road already built with electric motors to cost $60,000.

* * The Beverly & Danvers Street Railway Company has contracted with the Weston Electric Company to run its cars for the first year. The road will be built early this spring.

* * The Des Moines Electric Railway Company has contracted for a 200 horse-power Corliss engine and three 80 horse-power boilers. Des Moines and Sioux City companies obtained the contracts.

* * The San Diego electric railroad has been tied up indefinitely, through some misunderstanding between the manager of the road and the University Heights Company through whose land the road runs.

* * An extension of time has been granted to Mr. McLean in which to construct an electric road from Toledo, Ohio, to Glassboro. The Thomson-Houston Company gave bonds that the road would be built.

* * A movement is on foot at Altoona, Pa., to construct an electric street railway, open a city park and develop a large tract of valuable suburban property by a company of Altoona capitalists headed by Dr. S. C. Baker.

* * The directors of the Fort Worth, Texas, Land and Street Railway Company at a recent meeting, signed a contract with the Detroit Electrical Company of Detroit, Mich., for the placing of fifteen miles of their system using electricity.

* * The electric cars on the Omaha-Council Bluffs line are said to run faster than on any other street road in the country. A speed of 15 and often of 20 miles an hour is attained. The power plant consists of two 80 and one 40 horse-power generators.

* * The first newspaper ever printed in North Carolina by electric power was last week's issue of *County Homes*. It was printed in *The Asheville Citizen's* office, on a press driven by a Sprague electric motor. Hereafter, all the presses in the office will be run by this motor.

* * The new electric railway, at Cincinnati, which is being built for the Inclined Railway of that city, will be equipped with 20 cars to start with, the "Boston" motor being used with separate trucks. The design will enable the cars to be run in the winter closed and open in summer.

* * The promoters of the National Electric Tramway Co., Victoria, B. C., have assigned the franchise or charter granted by the city to Hon. J. H. Turner, in trust for shareholders. The promoters have reserved no stock or preferred shares, and will enter the company, when incorporated, on the same footing as other shareholders.

* * The Pennsylvania Railroad Company having obtained the right to erect poles and run wires for an electric railway at Atlantic City, have decided to adopt the Sprague system, and the contract has been given out to that company's agents, Messrs. Chadbourne, Hazelton & Co., who have their offices in the Drexel Building, Philadelphia.

* * In the Asbury Park directory occurs this name: "J. R. Borden, motorneer." Thus a new word has been coined for the language. A motorneer is the man who rides on the front of an electric car and handles the trolley, which runs on the wires overhead and conveys the electricity from the wires to the motor under the car.—*N. Y. Sun.*

* * In addition to the 15-mile electrical railway being built by the Detroit Electrical Works at Fort Worth, Tex., this company is also putting the Fisher system with five cars at Adrian, Mich., another with five cars at Elkhart, Ind., and also one with six cars at Decatur, Ill., all of which would indicate that the Fisher system is receiving quite a boom.

* * The Thomson-Houston Electric Company has the contract for furnishing the electrical apparatus for the Edgewood Street Railway, Atlanta, Ga. Mr. Joel Hurt, the president of the East Atlanta Land Company, went north twice and after investigation decided to adopt the Thomson-Houston system. This will be the first electric street railway in Atlanta and no doubt will be one of the best equipped in the country. Mr. H. E. W. Palmer is the southern business manager for the T.-H. Co., and with his skill and push the Thomson-Houston interests will be well taken care of in the south.

* * Articles of incorporation were filed at Los Angeles, Cal., by the San Gabriel Valley Rapid Transit Railway, for the purpose of operating a steam or electric railway from Los Angeles to Monrovia, a distance of 15 miles, also for carrying on manufacturing, mining, mercantile, mechanical, banking and commercial business. Los Angeles is to be their principal place of business. The following gentlemen are elected directors of the corporation: J. DeBarth Shorb, J. R. Dobbins, F. Q. Story, W. N. Monroe, J. J. Gosper, H. A. Unruh, J. D. Gilchrist, George H Bonebrake, and William G. Kerchoff. J. DeBarth Shorb is the president, H. A. Unruh, secretary, and F. Q. Story, treasurer of the corporation. The capital stock is placed at $250,000, of which $15,000 is subscribed.

* * The Legislative committee on street railways, of Massachusetts, gave a hearing on the order as to the use of electricity or other motive power by street railway companies. Mr. Frank H. Monks, treasurer of the East Middlesex Street Railway, favored a general law upon the subject, thus extending to all street railways the right which has been given by a special act to the West End road. Mr. Ira Copeland, vice-president of the East Side road of Brockton, expressed similar views as those advanced by Mr. Monks, and said that, while the use of electrictricity as a motive power would inferentially include the use of all the methods which the scientific condition of the utilization requires, it should be authoritatively so stated in the form of law.

A Big Electric Lighting Contract.

The contract for the incandescent plant for the new California hotel and theatre was awarded, February 8th, to J. H. Reed, of Chicago, general agent of the Mather system, for $19,940. The contract calls for the complete installation of 2,640 lights, four 400 light dynamos and three engines of prescribed make. The opposing bidders were the Electrical Development Company, agents of the Edison system, Mr. Samuel H. Taylor of the Thomson-Houston Company, and the Westinghouse Company, through Mr. W. C. Clark.

* * Judge Macomber handed down fourteen decisions this morning, the most important of which is that in favor of the Rochester Electric Railway. Village of Charlotte against the Rochester Electric Railway Company. Motion to dissolve injunction granted, on condition that the defendant gives a bond in the penalty of $2,000 that it will construct a separate crossing of its own over the tracks of the Rome, Watertown & Ogdensburg Railroad Company in three months; but the time in which the defendant's proceedings shall be stayed by the Rome, Watertown & Ogdensburg Railroad Company or other persons shall be deemed no part of such three months. The construction of the agreement between these parties ought to be reserved for the trial of the case, and not passed upon definitely upon this motion.

* * The National Pipe Bending Company, of New Haven, Conn., manufacturers of the National feed water heater, report the sale of over 40 National heaters during the month of January, aggregating over 4,000 horse-power. The list includes a numer of electric light stations furnished, including the new station of the Cambridge Electric Light Company, Cambridge, Mass., who now have two heaters of 500 horse-power each, and the Elgin Edison Electric Light Company, Elgin, Ill., who have one of the improved National heater, purifier and muffler. The sale of heaters for electric light plants in January aggregates over 2,000 horse-power, and they have orders from electric light plants for heaters aggregating 2,000 horse-power, to be delivered in February. The new improved heater, purifier and muffler will be greatly appreciated where the water prevents the use of the National heater.

* * The Boston *Herald*, in an editorial of January 17th, in commenting on the road, said: "Those who have made the experiment of taking a ride on the new electric railway on Beacon street, must have come to the conclusion that this method of securing rapid transit in the suburban wards is one of the most promising that has yet been brought forward in this city. The speed attained where the conditions are favorable is quite equal to that of the elevated railroads in New York city, while the structures supporting the electric wires are by no means as much of a disfigurement as it was at one time supposed that they might be. So long as a mixed service is maintained—that is, so long as some of the cars are drawn by horses—the full advantage of the electric system cannot be realized. The speed of the electric car has to conform to the speed of the horse car which may be in front of it, but if the experiment proves as successful as there is now every reason to think that it may, the West End Company will before long feel compelled to substitute electric for animal power in the service of all of its lines. When that change is brought about, the speed that can be made, even in the center of the city, will be very much accelerated over the average speed of to-day."

The Troubles of the Baxter Motor Company.

The Baxter Motor Company, of Baltimore, has entirely suspended the manufacture of motors and its future is a matter of uncertainty. Either the company will be reorganized with largely increased capital, and go on with the business, or the factory will be sold to one of the other companies. The Westinghouse, Thomson-Houston and the Sprague companies have been considering the question of purchasing it. The cause of the Baxter embarrassment appears to have been too much business and too little capital. A large sum of money was expended in erecting the factory, which affords room for 1,000 workman, and the company did not have sufficient additional capital to execute the orders for motors which it received. This undertaking is said to be the first business enterprise that J. F. Morrison ever engaged in without making a success of it, and the results of this venture would probably have been different if Mr. Morrison's advice had been followed. The other officers of the corporation, who knew nothing about electric matters, insisted on the policy pursued and now find themselves largely in debt.

The Electric Club.

The Electric Club is to be lighted from the street circuit, the Manhattan Electric Company, Ft. Wayne Jenney system, furnishing the light. This will obviate the heat from the boiler house during the hot summer months, which was an unpleasant feature last year. Current from the street circuit is to be turned on next week. The electric and steam plant which the Club owns will be used in case of accident and for heating, and this, with the storage batteries, make three means of lighting the Club, so it is scarcely possible that it will ever be left in darkness.

There was quite a reunion of old-time telephonists at the Club one evening recently, including Mr. Theo. N. Vail, E. T. Gilliland, H. L. Storke, W. D. Sargent, Thomas B. Doolittle, H. B. Thayer and others. These gentlemen are all fair and vigorous, and may live to see many other great inventions become commercially successful.

Mr. Henry C. Davis, who has been president of the Electric Club since its organization in May, 1886, has tendered his resignation on account of absence in Europe. At a meeting of the Board of Managers of the Club held last week, resolutions expressing the board's appreciation of the work done by Mr. Davis for the Club, and expressing regret over his resignation, were unanimously adopted. Mr. E. T. Gilliland, first vice-president of the Club, was unanimously elected president for the balance of the term, ending May 1st next. The pronounced success of the Electric Club may be very largely attributed to the earnest, loyal work of Mr. Davis, and the members of the Club generally regret that his business interests will keep him abroad for perhaps another year. In Mr. E. T. Gilliland the Club has a most able and worthy successor. This leaves one of the vice-presidencies vacant, and this vacancy will probably not be filled until the annual election two months hence.

The Electric Club was crowded last Saturday afternoon and evening by gentlemen who were present to arrange for their passage on the special "Electric" train for Chicago the following morning. An entire train had been chartered by the enterprising New York delegates, comprising three new Pullman cars, one accomodation car, which includes writing tables, smoking chairs, barber shop, etc., and dining car, the whole train being lighted by electricity. In another column appear the names of the delegates, and an account of the departure of the train Sunday morning.

The Electric Club has arranged for headquarters at the Paris Exposition, and will have a special letter-box in its headquarters, with attendants speaking both French and English in charge. The Club's headquarters will be immediately adjoining those of Mr. Abdank, who represents the Paris Exposition in this country, and through whose earnest efforts the extensive electrical exhibition from America has been secured and is now being forwarded to France. The Electric Club headquarters will be the general meeting place of all electrical people from this country, and a register will be kept in which will be noted the arrival of all electrical people and in addition will give the hotel at which they are stopping. We think this idea a very excellent one, and we have no doubt a great many members of the Electric Club and other electrical people will be recorded as visiting its headquarters before the Exposition is ended.

PERSONAL.

Mr. W. E. Stow, of Boston, and Mr. H. W. Hamblen, of Portland, Me., were among New York's electrical visitors last week.

Mr. H. D. Hall, former secretary and treasurer of the Induction Railway Telegraph Company, has recently become connected with the Empire City Electric Company, 15 Dey street, New York.

Mr. P. H. Alexander was elected general manager of the Sawyer-Man Electric Company at a meeting of the directors of the company held February 14th. Mr. Alexander succeeds Mr. H. M. Byllesby, who resigned at the same meeting.

The Lowrie-Hall Alternating Current System.

The following description of the House-to-House Co.'s plant at West Brompton, England, is taken from our esteemed contemporary, the London *Electrical Engineer*.

The central station has a total of 250 horse power, the engines being compound and running 88 revolutions per minute. Each engine drives a large alternating current dynamo of the Lowrie-Hall type, made by Elwell-Parker, Limited. They are multipolar alternating current machines, capable of maintaining, economically and safely, an output of 100,000 watts. The dynamos are worked well within their limits, the current in the armatures never rising above 2,000 amperes per square inch of section. The working E.M.F. is 2,000 volts, the number of alternations 10,000—or 5,000 complete phases per minute (83 phases per second). The speed is 380 revolutions per minute, and the mean speed at the revolving surface is about 6,000 feet per minute.

Mr. Lowrie considers the use of armatures without iron disadvantageous, for the reason that the rapidly rotating magnet must tend to drag round the strongest portion of the field out of position of greatest utility. The greatest point of interest about these machines is the fact that nearly the whole of the copper strip in the armature—about 87 per cent. of the whole—is in the active part of the field, only a small portion of the coils, and those, the turns, lying parallel to the direction of rotation, being idle, rendering the machine both economical of copper and extremely efficient. The armature consists of a large outer ring built up of laminated iron discs, 5ft. in diameter and 5in. wide. On the inner face of this ring are simply planted the copper coils, which are kept in place by wooden strips screwed to the outer frame of the dynamo. These coils are wound upon a core of wood, very slightly concave to the radius of the machine. The copper is in the form of strip, $\frac{3}{8}$in. wide by one millimetre thick, insulated with braided cotton saturated in shellac, with somewhere about 30 turns on each coil and 28 coils.

A peculiarity of this dynamo is that when the E.M.F. tends to fall owing to heat at full load, the magnet ring expands and pushes the magnets closer to the armature, thus increasing the field intensity. The result is a slightly higher E.M.F. when heated than when cool. The bearings of the dynamo are exceptionally strong and heavy, so that there is little fear of heating; but, in case of emergency, the bearings are all water-jacketed with supply from the water-tank, so that a constant stream of cold water can be carried around them. The bearings are split, and the tops can be easily lifted off. The brasses are made so that the lower brasses can be revolved in their grooves, and knocking out for repair or replacement. All lubricators are combined syphon and sight-feed. The bearings, 20 in. long, with side collars on one bearing to take side play. They are fitted with double oil grooves to catch the waste oil, which is run into a tank below and used again. The use of oil is extremely economical; best pure hydro-carbon oil is only used, tested for impurities before use, and used again and again.

The exciting current is supplied by a small Elwell-Parker dynamo. A tachometer, by Schaeffer and Budenberg, Magdeburg and Manchester, is run from the axle of the dynamo for indication of speed. The weight of the dynamo is 10 tons.

The transformers used by the House-to-House Company are shown in the illustrations. Two forms are used, upright and horizontal, for use according to the position. The Lowrie-Hall meter may be briefly described as a combination of secondary cell and electrolytic cell; the alternate current not having any effect upon the electrolytic cell, the secondary cell acts in its own direction along the circuit proportionately to the number of lamps alight, the electrolytic effect being thus the measure of the current.

The regulation of the dynamo is effected to within a variation of one per cent. by the Lowrie-Hall regulator. In this the heating effect of the alternate current is utilized. The sag in a long iron wire lengthened by heating, moves, without the disadvantage of friction, a tipping lever which sends an electric current one way or other, and alters a liquid resistance inserted in the exciting circuit.

An ingenious method is used to test the insulation of the underground mains. On every circuit carrying high tension alternating currents, a certain static charge is generated. If the insulation is perfect, this can only escape to earth at the dynamo terminals. This static charge is here utilized to show a glow discharge, when the switch-board terminal is connected to earth, in a vacuum tube, arranged in a dark box, with a funnel for inspection, as shown. The degree of luminosity seen is a test of the insulation of the mains.

—— Portable electric lights, arranged to hang on a button of one's coat, and with a parabolic reflector to concentrate the light, with storage batteries weighing 1½ pounds each, are made to enable persons to read in railroad cars by night.

—— The Duluth (Minn.) Electric Light and Power Company has increased its capital stock from $60,000 to $200,000. Its old directors have been re elected with the exception of James T. Hale, superseded by Major H. Upham, a large stockholder.

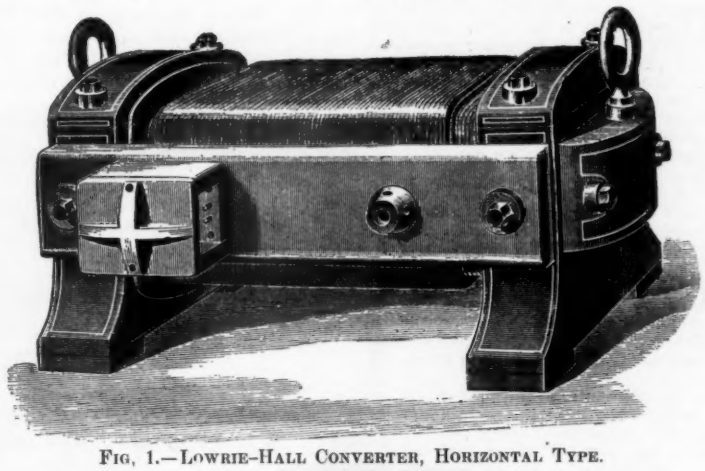


FIG. 1.—LOWRIE-HALL CONVERTER, HORIZONTAL TYPE.

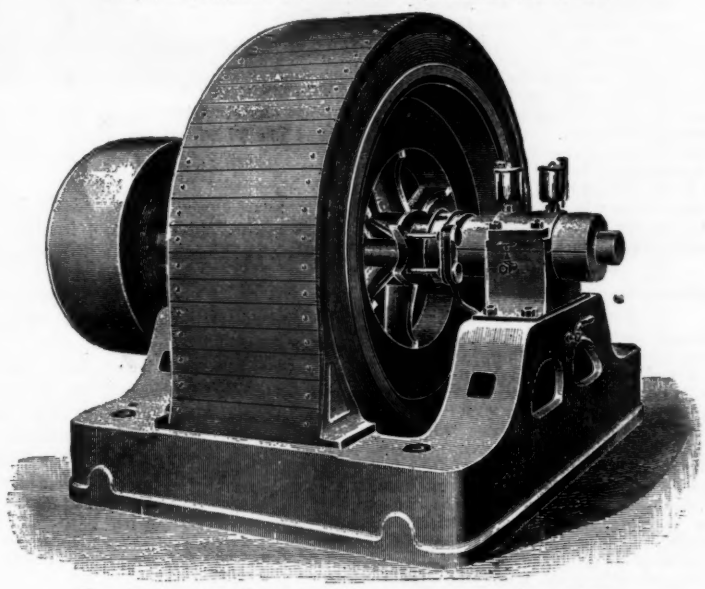


FIG. 2.—LOWRIE-HALL ALTERNATING CURRENT GENERATOR.

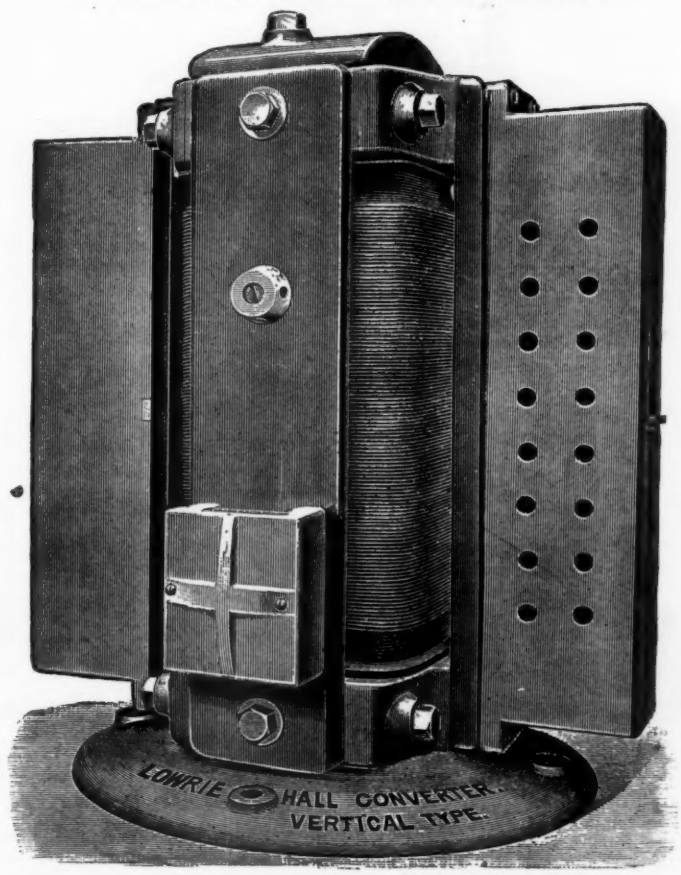


FIG. 3.—LOWRIE-HALL CONVERTER, VERTICAL TYPE.

—— The Ware, Mass., Electric Light Company has purchased the plant in that place from the Thomson-Houston Company, and the stockholders will soon meet to see what action they will take in regard to increasing the capital to $30,000.

—— Applications have been made to the Maine legislature asking for charters for the Persian Railway Company, a part of whose efforts are to be devoted to building telegraph and telephone lines and the establishment of electric lighting plants in far away Persia.

ELECTRIC LIGHT NEWS

—— Electric lighting is increasing in Buffalo, N. Y., gas being supplanted.

—— The Standard cotton mills, of Rock Hill, S. C., have purchased electric light machinery for their cotton mill.

—— The contract for wiring the new Y. M. C. A. building in Utica, N. Y., for incandescent electric lights has been awarded to T. P. Nightingale.

—— The Westinghouse Electric Company are said to be at work on a dynamo at Pittsburgh that will light 5,000 incandescent lamps, and weighs 30,000 pounds.

—— Long Beach, near Los Angeles, Cal., is endeavoring to secure electric lights from the San Pedro plant. The current will have to be carried across the bay by means of a cable.

—— W. C. Clark, agent for the Westinghouse Electric Light Company, has contracted with the Chico (Cal.) Gas Company to furnish a fine arc light plant. The system is sure to be in operation within 30 days.

—— The *Chronicle-Telegram*, of Pittsburgh, of February 5th, says: "Contracts for electric light plants aggregating 24,250 lights were secured by the Westinghouse Company yesterday in New York, St. Louis and Council Bluffs, Iowa."

—— At the annual meeting of stockholders of the Newark Schuyler Electric Light Company, the following directors were elected; Gottfried Krueger, F. G. Waterhouse, Samuel Streit, J. Frank Fort, Ellias R. Carhuff, William M. Clark, Louis J. Lyons, George M. Ballard, Samuel Klotz.

—— The Jersey City Electric Light Company has purchased ground in Jersey City near the hill at Wayne and Montgomery streets, and will build a two-story building, 200 by 150 feet. When it is completed the company's lines will be extended and private residences will be lighted with incandescent lights.

—— At the annual meeting of the stockholders of the Edison Electric Light Company, Detroit, Mich., the following directors were elected for the ensuing year: George Peck, George F. Moore, S. J. Murphy, Samuel R. Mumford, F. S. Hastings, Hoyt Post, Robert McMillan, E. W. Voigt, C. P. Gilbert.

—— The electric lights at St. Johnsbury, Vt., are in full operation, and are giving unusual satisfaction. The old board of trustees are receiving congratulations over the result of their contract. One old grumbler stated that the lights were all right, but were "too bright" for him, as they injured his eyes.

—— Engineer Francis and City Solicitor Mitchell, of Bangor, Me., have reported on the question of power capacity at the water works and legality, respectively, should the city decide to use the surplus power at the water works to run machinery to furnish electricity for the necessary lights for the streets and city buildings. The reports are favorable to the project.

—— The annual meeting of the Somerville, Mass., Electric Light Company was held Monday evening. It was voted to increase the capital stock 50 per cent. to $120,000. The following directors for the ensuing year were chosen: President E. H. Capen, of Tuft's College, David Cummings, A. E. Dolbear, R. E. Nickerson, F. S. Pearson, H. C. Buck, H. M. Moore, Dr. A. H. Carroll, L. E. Merry. The directors organized by the choice of Mr. Capen as president, David Cummings as vice-president, and F. S. Pearson as treasurer, of Boston.

ELECTRIC LIGHT NEWS

(SUPPLEMENTARY.)

—— An electric light system is projected in Wytheville, Va.; address Chas. W. Gleaves.

—— Green Island, N. Y., is to have arc and incandescent lights of the T-H systems.

—— The Calumet Gas Company, of South Chicago, Ill., will put in an electric light system.

—— An electric light plant is projected in Laurens, S. C. The Edison system will probably be used.

—— The city of Clinton, Wis., has contracted with a Chicago company for 125 incandescent lights.

—— The new Wolfskill depot in Southern California is resplendent with electrical illumination, using an isolated plant.

—— The contract for electric lighting in Helena, Mont., has been awarded to the Helena Steam Power & Lighting Company.

—— Several Washington, D. C., lighting companies were fined for not keeping all their lights burning during the month of January.

—— Baton Rouge, La., has contracted with the Van Depoele Company for 300 incandescent and 60 arc lights. The plants will be in operation in March.

—— The contract for supplying 50 electric street lights for Huntington, W. Va., has been awarded to J. J. Cadwell for $3,600 and $50 for each additional light.

—— The Independence water, gas and electric light plants have been purchased by Mr. C. H. Malin, of Fort Scott, Kans., through Brewster & Wilson, of Kansas City, for a Philadelphia syndicate.

—— The Aberdeen (Me.) Electric Light Company has recently purchased a new 125 horse-power Russell engine. The present building will at once be enlarged with a view of doubling the capacity of the company's business.

—— A contract has been closed between the Rockland Electric Light and Gas Power Company and the Eastern Electric Construction Company, through which Rockland is to have an arc and incandescent plant of the Thomson-Houston system.

—— The Brookline, Mass., Electric Light Company has received a new 1,000-light Thomson-Houston alternating dynamo, capable of 1,050 revolutions a minute. This machine will be used to furnish incandescent lights for the town hall, police station and public library of Brookline.

—— The Brush Electric Company were awarded last week the contract of about $25,000 to furnish apparatus for lighting the city of Bangor, Me. There will be 160 arc lights, which will be furnished with power by the water works of the city. It will require about 100 horse power to run these lights.

—— The following proposals for electric lighting for three years have been received by the Board of Public Works and Affairs of Nashville, Tenn.: Thomson-Houston Company, 23½ cts. per light per night; Nashville Light & Power Company, 40 cts.; Jenney Electric Light Company, of Indianapolis, 47 cts. The contract was awarded to the Thomson-Houston Company.

—— In the course of an address on the Progress of the City of Jackson, Miss., during the past year, President Peeples, of the Board of Trade, says: "The waterworks and electric lights, now in a fair way of completion, are evidences of an enlightened spirit and disposition to keep abreast of the times, and are in a large degree due to the exertion and influence of your board."

Electric Railways.

Since the successful inauguration of the Sprague Electric road at Boston, owned by the West End Street Railway Company, and its durability, reliability and advantages over the horse railroads have been made apparent even in such large cities as Boston, the greatest interest has been manifested all over the country in this easy, convenient, economical method of street car propulsion.

Large cities are now debating the question why, since electric railways have proved such a success in large cities like Cleveland and Boston, they cannot be introduced to solve the question of rapid transit which is now such a very serious problem in so many cities.

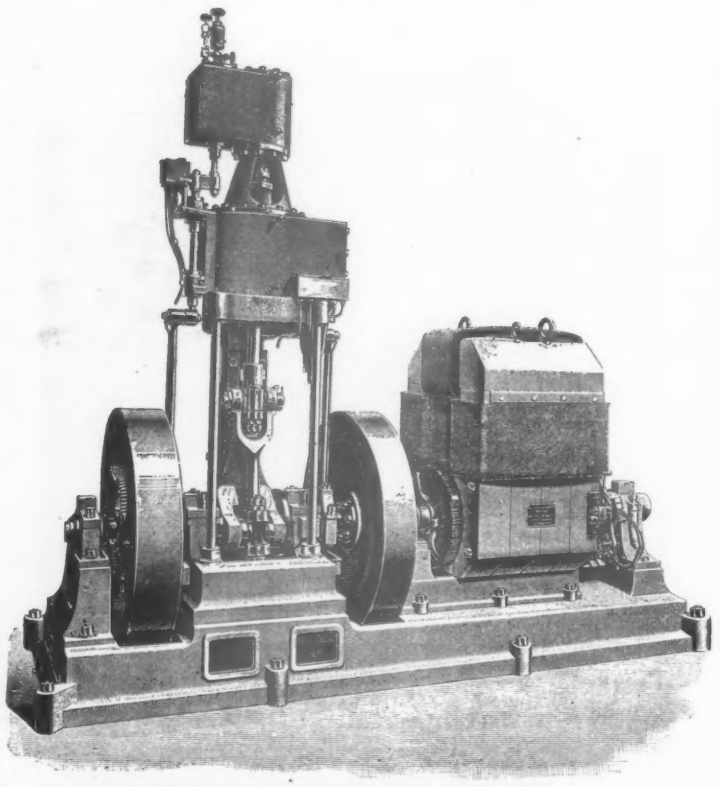
We note with interest that the Philadelphia *Public Ledger*, among other large and influential papers, has devoted considerable attention in both its news and editorial columns to this subject, incident to the starting up of the West End road, of Boston, and questions why a system which has proved so successful in this latter city could not be introduced to supplant the slow horse car in Philadelphia.

On account of its capacity for speeding, an electric car, for the same hours of service, should make about twice as many miles per day as an ordinary horse car, and owing to the remarkable control which the operator has over the motion of the car, it can be stopped much more quickly. Even when running at twice the speed, it is much more safe and less liable to collision with any obstruction on the track than an ordinary horse car.

There is no reason why electric cars should not be introduced into all the large cities like New York, Philadelphia, Chicago, St. Louis, and other cities where the question of rapid transit is now a very serious one, and is growing more serious every day.

Engine and Dynamo for Deptford Electric Lighting Station.

We are indebted to our esteemed contemporary, *Industries* of London, for the illustration which represents a combined form of exciter and inverted engine, constructed by Messrs. W. H. Allen & Co., Lambeth, England, and is one of a series being supplied to the London Electric Supply Corporation for their new works at Deptford, under the specification of their engineer, Mr. S. Z. de Ferranti. The dynamo is constructed upon Allen and Kapp's patent, and is specially made for free ventilation and direct driving. The output of the machine is 300 amperes at 50 volts, while the speed is only 175 revolutions per minute. The engine is designed for a steam pressure of 200 lb. on the square inch, and is of the tandem form, the high pressure cylinder being 5¼ in. in diameter and the low pressure 12½ in., with a stroke of 8 in. The valve of the high pressure cylinder is of the piston form and is controlled by a special governor of the Hartnell type, the valve of the low pressure cylinder being worked by a separate eccentric. The whole combination forms a very complete and substantial machine.

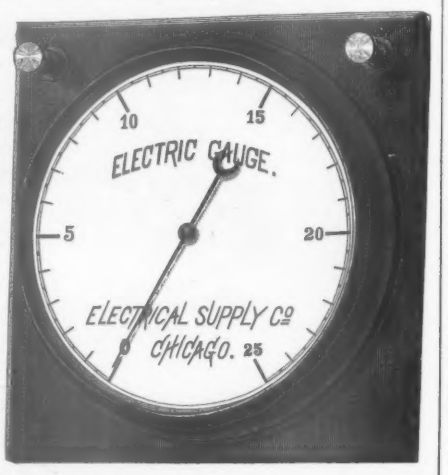


COMBINED FORM OF DYNAMO AND ENGINE.

The Electric Gauge.

The accompanying cut represents an electric gauge or ammeter for arc work recently brought out by the Electrical Supply Co., Chicago, and designed to be used in connection with station work. They are ornamental in design and accurate as to reading.

The principal advantage is that for a small variation in current, the index travels a considerable distance upon the dial, and is therefore visible by a distant observer, more so than any other instrument upon the market. The additional advantage is that they are comparatively inexpensive considering that they are accurate.



The dial is 8" in diameter and the instruments are calibrated to read from 0 to 15 amperes, and from 0 to 25 amperes, through a range of 300 degrees.

The principal demand is with officers and directors of arc light companies. The ammeters are located anywhere upon the circuit which may be miles in length, and are placed in the offices of the president, electrician and other officers of the company, so that they can at any time see exactly the condition of the current upon the entire line, it being a constant check upon the engineer and attendant at the station. For station work they are invaluable owing to the fact that they can be seen from any point near or far, the engineer's eye becoming readily accustomed to the angle.

—— Rochester, N. Y., is to have a new Westinghouse lighting plant.

—— A bill for electric lighting before the Butte, Mon., city council created a little discussion. Alderman Monteath stated that after investigation he had come to the conclusion that Butte was lighted cheaper than any other city of its size, and he did not think there was any kick coming.

Electrical Traction on the City of London and Southwark Subway.

The City of London and Southwark Subway consists of two tunnels, each 10 ft. 6 in. in diameter, formed of segmented cast iron plates. It extends from the Stockwell terminus at Clapham road, by the Oval and Elephant and Castle at Newington, and then under the Thames to the city terminus at King William street, the total length of each tunnel exceeding three miles.

Quite recently it was decided to adopt electric traction, and the directors entered into communication with Messrs. Mather and Platt, of Manchester, on whose behalf Dr. Edward Hopkinson, the managing partner of their electrical department, prepared a detailed and elaborate scheme, which has been adopted in its entirety, as affording a perfectly satisfactory and feasible solution of the problem, and a contract has been placed with them for the carrying out of the entire work.

The generating plant will be placed at the Stockwell terminus, where boiler and engine plant of over 1,000 horse-power will be erected, and three large Edison-Hopkinson generating dynamos. The current will be conveyed by a lead-covered cable throughout the whole length of the line, and Dr. John Hopkinson's system of overhead conductors will be adopted for conveying the current to the locomotives.

There will be 14 electrical locomotives, each capable of developing 100 horse-power, which is sufficient for moving a train containing 100 passengers at 25 miles per hour, and for providing the great power required for starting rapidly. The trains will run at intervals of three minutes, and consist of three cars.

In addition to the plant required for electrical traction, Messrs. Mather and Platt's contract includes the lighting of the trains, and of the stations and of the hydraulic lifts and approaches.

—— Mayor Glover, of Marietta, Ga., has the matter of lighting the city by electricity in charge.

—— Dansville, N. Y., voted overwhelmingly for electrical illumination, and lights will be ready by April 1st.

—— The electric light company of Bridgeton, N. J., proposes to add an incandescent plant to furnish 1,200 lights.

—— Information as to cost for machinery for a 25 arc electric light plant is wanted by the Commercial Club, Princeton, Ky.

—— A fire alarm system is to be established at Anniston, Ala. The mayor can give information regarding the matter.

—— The Charlotte, N. C., Gas Light Company contemplate building an electric light plant this spring, and are now securing bids.

—— H. L. Mayward and John L. Watson, of Portsmouth, Va., are prospecting with a view to erecting an electric light plant for incandescent lighting.

—— The Winchester, Va., Gas Company will erect an arc and incandescent electric light plant if the city decides to have the town lighted by electricity.

—— Thomas Jeffers, at Birmingham, Ala., has been elected president of the Merchants' Electric Light and Power Company. Work will soon be begun on the plant.

—— The Secretary of the Treasury, Washington, D. C., will receive proposals for lighting the new U. S. post office building at Baltimore, Md., with electricity, until February 25th.

—— At a recent meeting of the Boston City Council it was ordered that a special committee, to consist of five members of the Common Council, with such as the Board of Aldermen may join, be appointed to consider the subject of electric and other lighting, to include the practicability and expediency of the erection and maintenance by the city of an electric light plant and gas works, said committee to report recommendations, with a view of reducing the cost to the city of such lighting.

MANUFACTURING NOTES.

The Westinghouse Electric Company has a few words to say in two pages of advertising which appear in the ELECTRICAL REVIEW this week. Also, the U. S. Company.

The Wichita (Kans.) Electric Bell Company (B. C. Elder & Company) is engaged in placing all kinds of electrical appliances. The progressive West is a fruitful field for wideawake electrical workers.

Messrs. J. H. Bunnell & Company are meeting with great success in the sale of the Eickemeyer dynamos and electric motors. Mr. Eickemeyer's work is meeting with appreciation in all parts of the country.

The new form of dynamo manufactured by the Mather Electric Company, which was recently illustrated in the ELECTRICAL REVIEW, has struck a popular chord among patrons of electric lighting and handsome machines.

The Electrical Accumulator Company, 44 Broadway, New York, has had the satisfaction of placing a large number of storage battery plants within the last four or five months. The western demand for this storage battery has greatly increased of late.

The new Manning boiler, controlled by Messrs. Charles R. Vincent & Co., of New York, promises to meet the time-tried and well-known Babcock & Wilson boiler on its own ground, and compete with it in a way that will be quite lively and interesting to purchasers of boilers.

We note the election to the presidency of the Schenk Belt-Holder and Shifter Co., of New York, of Mr. E. P. Gleason, of the Gleason Manufacturing Co., who has acquired a large interest. This fact is not only a tribute to the shrewdness of Mr. Gleason, but to the merits of the invention of Mr. U. H. W. Schenck.

The New York office of the Eddy Electric Manufacturing Company, 115 Broadway, is becoming a point for visits from purchasers of electrical apparatus. The works at Windsor, Conn., are crowded with orders at the present time, and will, no doubt, continue to be so, for as the motor becomes more widely known, just so much more is its popularity increased.

The new battery just brought out by the Leclanche Battery Company, of New York, is attracting much attention from the users of primary batteries. There are a great many points of excellence in the Axo battery, and General Manager Brewer, of the Leclanche Battery Company, deserves the thanks of battery users for presenting them with these improvements.

The REVIEW is ever pleased to announce the success of young men in the electrical field, and the large business which Messrs. Hazazer & Stanley have secured in their manufacture of electrical supplies and electrical house furnishings, is what is undoubtedly deserved. These gentlemen are industrious, capable and experienced electricians, and the REVIEW congratulates them.

The Star Iron Tower Company, Fort Wayne, Ind., in the manufacture of towers and mast arms, has been very successful. The demand, particularly for mast arms, is greatly increasing, and this company which was first in the field has very naturally secured the cream of the business. Their improved mast arm is decidedly popular with all electric lighting companies who have tried it.

The Phœnix Glass Company has recently issued an artistic and very striking circular, calling attention to a particularly serviceable and strong arc light globe, as meeting a demand that has long existed for something of this kind. The Phœnix Company has commenced the manufacture of battery jars of all kinds and sizes, and with its unsurpassed facilities is able to turn out a magnificent quality of glass jars.

No manufacturer is more wide-awake to the demands of the time than the Gleason Manufacturing Company of this city. The intelligent work of Mr. E. F. Gennert in perfecting the details for electrical fixtures and electrical supplies of all kinds for lighting purposes, is very noticeable in the goods sent out by this long-established house. It takes many little details to make up a perfect whole, and purchasers from this house have begun to fully appreciate the fact that everything received there can be relied upon. A new catalogue of 1889 has just been issued and will be sent on application.

Messrs. Baker & Company, refiners smelters, etc., of platinum, Newark, N. J., certainly have reason to be proud of the many strong and unusually complimentary testimonials which are presented in the REVIEW this week. This energetic firm has built up a magnificent business in electrical circles and has recently been compelled to double the factory facilities. They are now running an extra force day and night.

The New England Electric Supply Company, 80 and 84 John street, Bridgeport, Conn., is making a general line of incandescent supplies, is bringing out the "Bryant" new double pole switch, and is the New England agent of the Paisté switch. Messrs. J. M. Orford and John C. English are the gentlemen at the head of this company, and they will undoubtedly meet with much patronage in the excellent territory they cover.

The Knapp Electrical Works, 54 and 56 Frankfort street, Chicago, is a very successful Western electrical house, that owes its present position to the energy and ability of General Manager Knapp. These electrical works have been continually extending during the last four or five years, and the REVIEW is glad to express to Mr. Knapp its appreciation of the success he has personally wrought out in the midst of active competition.

The E. S. Greeley and Company, New York, one of the oldest electrical houses in the United States, has not depended upon its great reputation, but has kept abreast of the electrical manufacturers, and is to-day in the front rank. Colonel Goodyear, who is largely responsible for this state of things, has only to complain that customers are so persistent and numerous that he has had to shorten his 13 hours of sleep to five hours, and still has difficulty in keeping up with the business.

The Western Electric Company of Chicago, whose magnificent building will be a great point of attraction all this week to the delegates to the National Electric Light Association, will after the first of March next have to look well to its laurels, for the new New York factory will then be ready for occupancy, and will be one of the most substantial, and convenient, and extensive establishments for the purposes in the East, and will at that time be occupied by the New York staff of the company.

The Brush Electric Company, Cleveland, Ohio, although other companies may come and go, still goes on the even tenor of its way securing magnificent business from the companies organized years ago in all the large cities of the United States, and besides is securing a fair portion of the electric lighting in new towns of the country. The Brush works at Cleveland are very extensive, and possess every facility for turning out readily the highest grade of electric lighting and electric power apparatus.

The Detroit Electrical Works, in introducing the Fisher-Rae system, though meeting with the usual obstacles that go with new work in any particular industry, has finally so successfully overcome the difficulties that it announces its readiness to contract for all kinds of electric railroads. A number of roads using this system are in successful operation, and when a company like the Detroit Electrical Works is willing to back up an electrical system, our readers may be certain that it possesses the necessary merit.

The new catalogue of the Empire City Electric Company has just made its appearance, and outside and inside is of such a character as to attract even the most casual observer. The outside cover is of striking design, the name of the company appearing in letters of black and gold amid discharges of forked lightning. The inside pages are devoted to descriptions of the electrical supplies of every description manufactured by the company, all fully illustrated with handsome cuts. Many valuable wire tables are also given, adding to the value of the book for reference.

One of the most careful and well informed manufacturers of insulated wires and cables is Mr. W. M. Habirshaw, chemical engineer, who is general manager of the India Rubber and Gutta Percha Insulating Company, 159 Front street, New York. All his wire is of the best quality, and the users of the highest grades are rapidly appreciating the fact that Mr. Habirshaw never permits an inferior insulation to leave his factory.

A Peculiar Accident.

George D. Johnson, the chief engineer at the Hartford Electric Light Company's works, had a slight headache, and to relieve his sufferings bathed his head with a liberal quantity of alcohol. Shortly afterward he stepped under one of the big belts and near one of the dynamos, and his hair was immediately ignited by a spark of electricity. He grabbed an old jumper that hung on the wall near by, and succeeded in smothering the flames. Mr. Johnson is not very seriously burned, but his appearance now is somewhat different from what it was.

SECTIONAL VIEW OF THE MANNING VERTICAL TUBULAR BOILER.

—— The Willimantic, Ct., Electric Light Company has increased its capital stock from $10,000 to $20,000.

—— It is suggested in Springfield, Mass., to put in furnaces for cremating garbage and use the same heat for furnishing steam for an electric light plant.

—— The Mobile Ice Factory Company, Mobile, Ala., want to purchase incandescent electric light machinery with a capacity of about 40 lights.

An Improved Steam Boiler.

The Manning vertical tubular boiler, sectional view of which is given in this number, is offered by C. R. Vincent & Co., of 15 Cortlandt street, New York, in competition with the better class and best known types of boilers now on the market, with the assurance that it is second to none in any feature pertaining to a steam generator, as it embodies every element of value. We present the following points of merit which the manufacturers claim:

Safety: As it is an internally fired boiler, the heat is transmitted to the water by the tubes and inner fire box, and not through the shell; the latter may be as thick as required to carry any desired pressure.

Economy: The design of the boiler requires great depth of water on the lower tube sheet, from 10 to 12 feet; this body of water is subdivided by a large number of tubes of proper diameter, through which the heat passes; the depth of the water is such that by the time the heat reaches its upper surface it has been absorbed through the thin metal of which the tubes are made. The temperature of the escaping gases is but slightly above that due to the pressure of steam, superheating the latter some 10 degrees and maintaining ample draft, but in no case is the temperature of these gases high enough to at all impair the efficiency of the boiler, or to cause the ends of tubes to burn out or leak in the slightest degree.

It follows that if the heat generated in the furnace is thoroughly absorbed by the water in the boiler, then a maximum efficiency is obtained.

Duty Test: A test of a Manning boiler which contained 1,403 square feet of water-heating surface, after being in service for more than one year, no preparations for obtaining special showing being made, gave the following results:

Water evaporated per hour	5,666 lbs.
" " " lb. coal	9,594 "
" " " " combustible	10,260 "
Equivalent evaporation per lb. of combustible from and at 212 degrees	10,685 "

At 30 pounds of steam per horse-power the above duty is equal to 188.66 horse-power.

The economy test showed from 10 to 12 per cent. better results than the above.

Simplicity: The design of the boiler, as shown in the sectional view, is of the most simple construction.

Durability: The feature of internal firing is well known and appreciated by engineers as conducive to a long-lived boiler.

Floor Space Occupied: These boilers vary in size from 100 to 250 horse-power rated capacity, and occupy a floor space from six feet to 10 feet in diameter.

Tour of Inspection by the Electrical Engineers of Cornell University.

The annual inspection tour of the mechanical and electrical engineering students of Cornell University will be taken during the coming spring vacation. There are four distinct routes to be taken, two east and two west. The western route taken by the electrical engineers will include Rochester, Lockport, Buffalo, Pittsburgh and Cleveland. At Rochester the engineers will visit the electric lighting stations and Power's art gallery; at Lockport they will inspect the city lighting stations and the Cowles Electric Aluminum Smelting Works; they will then proceed to Niagara Falls to spend the Sunday. Monday, March 25th, they visit Buffalo's electric lighting and isolated plants, including that in the new Opera House. At Pittsburgh they will make a study of the electric railways; they will then take in the works of the Westinghouse Electric Company, the Standard Underground Cable Company, the Faraday Carbon Company, and other industrial establishments of interest to electrical engineers; at Cleveland a visit will be made to the Brush Electric Co.'s works and the Standard and National Carbon Co.'s works; the evening will be spent at the electric lighting stations of that city.

The electrical engineers going east will visit, Troy, Albany, Schenectady, New York, Brooklyn, Newark, Orange and Scranton. On Friday, March 22d, they visit the Eickemeyer works at Yonkers; on the following days they will inspect the Edison machine works, Julien R. R. station, Daft, and Excelsior electric works, Pratt institute trade schools, Gibson storage battery works, Edison's laboratory, Ed. Weston's laboratory Daft power stations, and in the evening visiting the electric light stations and isolated plants. A very interesting and instructing time is expected by those who join these parties. The entire tour is under the charge of Dr. R. H. Thurston, director of Sibley College, and he has taken great care that everything should be done that is possible to make this tour the best which has ever been made in the history of Cornell University. Prof. E. P. Roberts has the direct charge of the eastern tour and Prof. Edward Nichols that of the western.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING FEBRUARY 12, 1889.

397,194 Multiple signal transmitter; Morris Martin, Malden, Mass.

397,221 Junction box for electrical conductors; William M. Callender, New York, N. Y.

397,235 Method of forming secondary battery electrodes; Rudolph M. Hunter, Philadelphia, Pa.

397,280 Phonograph recorder and reproducer; Thomas A. Edison, Llewellyn Park, N. J.

397,320 Process of making dental plates by electro-deposition; Joseph G. Ward, Irvington, N. J.

397,364 Electric communicating system; Alfred G. Holcombe, New York, N. Y., assignor to the Equitable Electric Company, same place.

397,385 Cable or electric street railway; William S. Phelps, San Francisco, Cal.

397,392 Armature for dynamo electric machine; Oliver B. Shallenberger, Rochester, N. Y.

397,418 Protector for electrical instruments; Joseph E. Crandall, Washington, D. C.

397,423 Method of demagnetizing watches; John Greaves, St. Louis, Mo.

397,424 Connection of electrical circuits; William W. Griscom, Haverford College, and Henry N. Weidner, Philadelphia, assignors to the Electro-Dynamic Company, Philadelphia, Pa.

397,439 Dynamo-electric machine and motor; Francis J. Patten, New York, N. Y.

397,443 Secondary battery; William A. Shaw, Brooklyn, assignor to the Electrical Accumulator Company, New York, N. Y.

397,451 Overhead contact and switch; Charles J. Van Depoele, Lynn, Mass.

397,461 Electric converter; Ludwig Gutman, Fort Wayne, Ind.

377,466 Printing telegraph; Andrew T. McCoy, Boston, Mass., assignor to John Anderson, New York, N. Y.

397,472 Telephone paper pad holder; John B. Seymour, Jr., St. Louis, Mo., assignor of one-half to Stephen G. Adams, same place.

397,474 Therapeutical electrode; Lucius T. Stanley, Brooklyn, N. Y., assignor to the Stanley Electric Company, Philadelphia, Pa.

397,479 Incandescent lamp manufacture; James A. Vandergrift, Newark, N. J.

397,489 Method of protecting the negative plates of electrical batteries; Francis J. Clamer and Joseph G. Hendrickson, Philadelphia, Pa.

397,492 Brush for electric generators; Rudolph Eickemeyer, Yonkers, N. Y.

397,526 Galvanic battery; Colin M. Thompson, Brooklyn, N. Y.

397,537 Electrical stop motion mechanism for knitting machines; Edward G. Conner, Valatie, assignor to Tompkins Bros., Troy, N. Y.

397,598 Electric meter; Henry H. Cutler, Newton, Mass.

397,548 Telethermometer; Carl G. Hoffman, Leipsic, Saxony, Germany.

397,550 Dynamo electric machine; Rudolph M. Hunter, Philadelphia, Pa.

397,553 Electric coupling for railway train signaling; William P. Johnston, Jr., Lynn, Mass.

397,557 Secondary battery plate; Edward R. Knowles, Brooklyn, N. Y.

397,594 Electro-magnetic grain scale; William A. Holley and Ulrik Malin, Holland, Mich.

REISSUES.

10,980 Wire and pipe supporting and snow removing apparatus; Sylvanus D. Locke, Hoosick Falls, N. Y.

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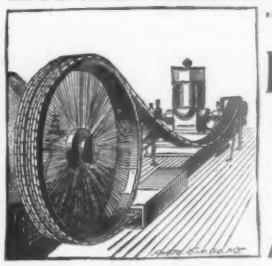

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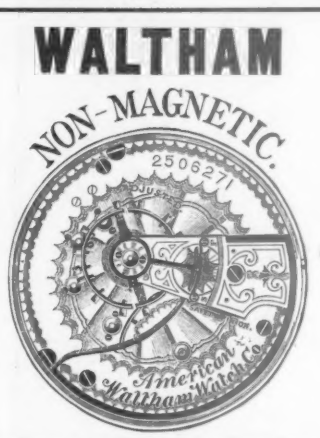

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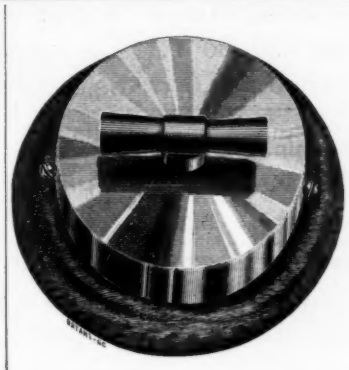

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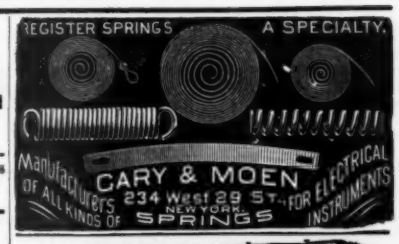
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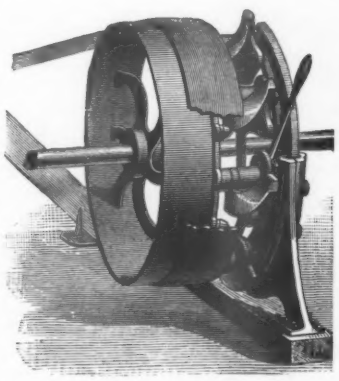

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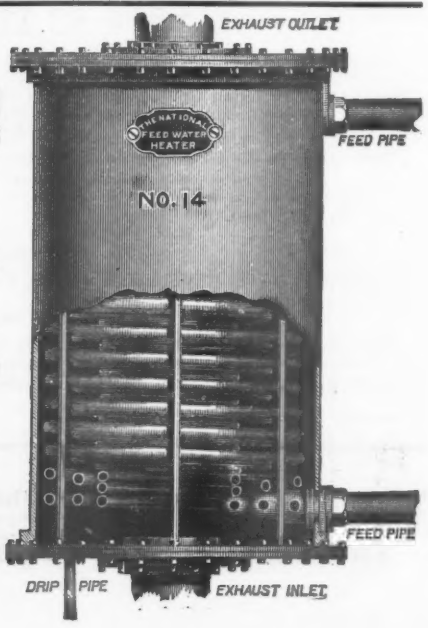

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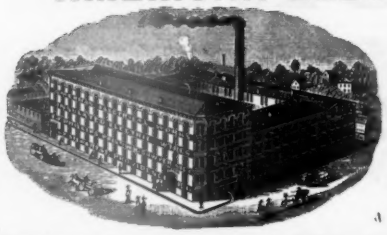

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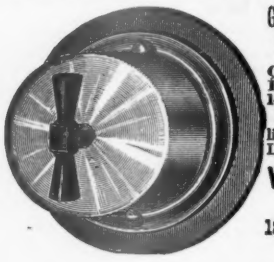

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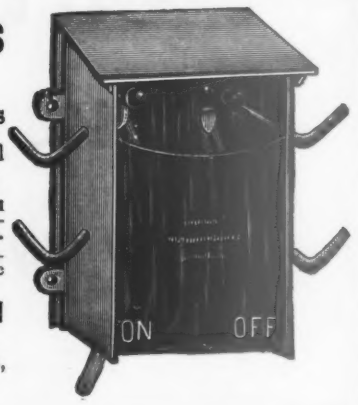

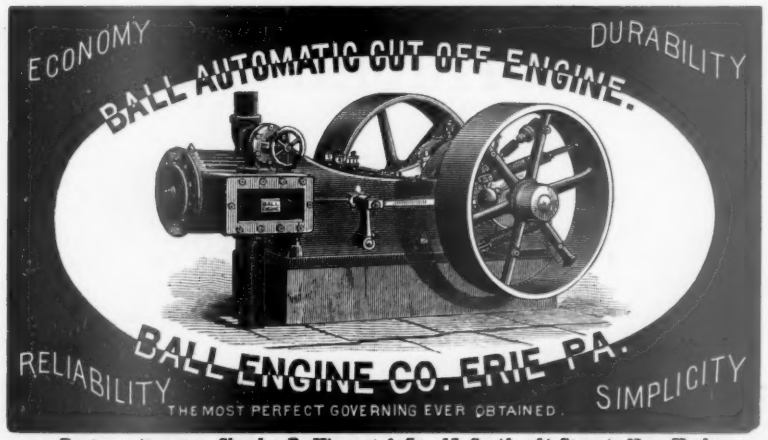

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INDISPENSABLE TO INTELLIGENT MANAGEMENT.

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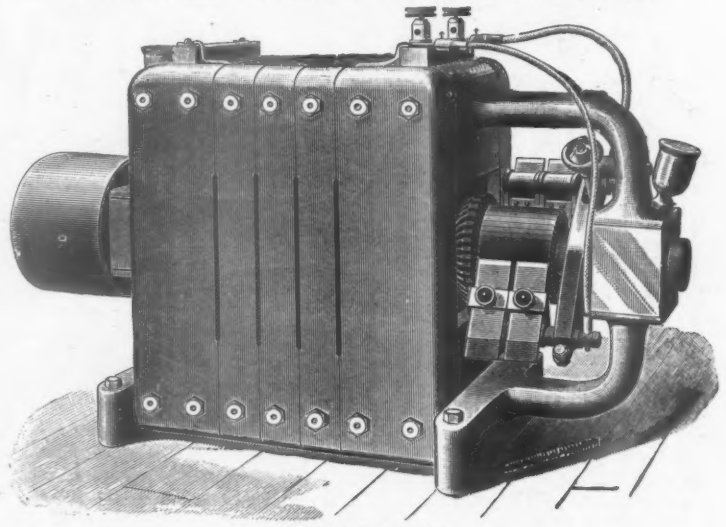
EICKEMEYER DYNAMOS AND ELECTRIC MOTORS.

(United States Patents, Feb. 22, 1887; Feb. 14, 1888.)



Machine Complete.

Combine the Simplest Construction and Highest Efficiency yet obtained in Dynamo-Electrical Apparatus.

PERFECT ELECTRICAL BALANCE IN ARMATURE COILS. NO RADIATION OF FIELD MAGNETISM.

There being no magnetism apparent at any exposed surface of the machine, all the lines of force are concentrated within the machine and pass through the armature.

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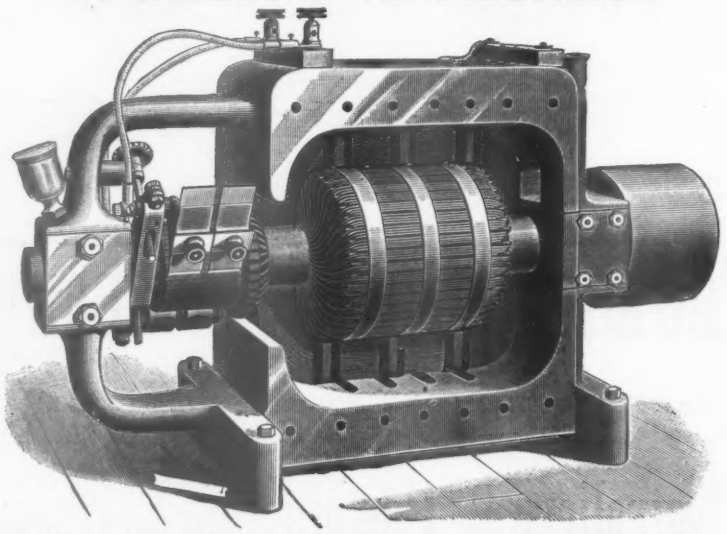

Machine with one side and half the field coils removed, showing the inside arrangement of armature and coils.

These machines, in all sizes, and of any required capacity, are for general sale on their merits **TO THE TRADE**, to **CONTRACTING ENGINEERS**, to **ELECTRIC LIGHT AND POWER COMPANIES**, and to the public, without restrictions or royalties as to territory or patents.

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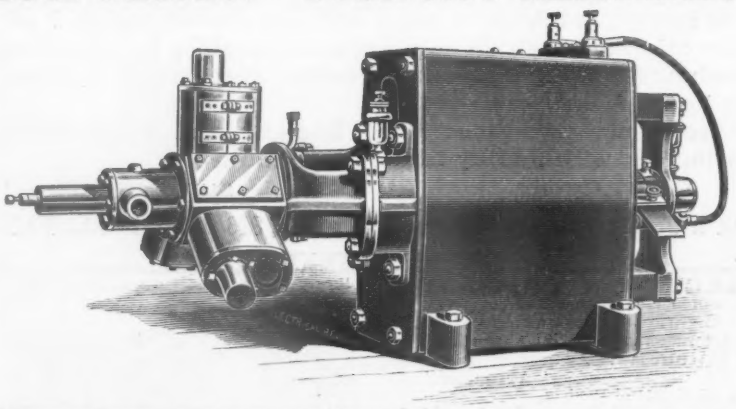

Eickemeyer Dynamo with Brotherhood Engine directly attached as applied to Electric Plant on Steam Yacht "Lorna."

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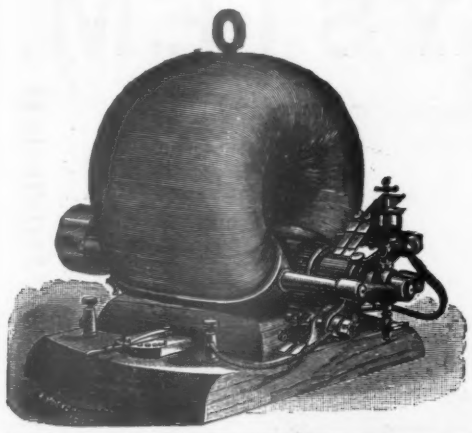

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Ball Electric Light Co.
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The Celebrated BALL DYNAMOS and LAMPS

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ARC AND INCANDESCENT LIGHTING.

This System is **mechanically** and **electrically** perfect and produces a steady, white and noiseless light with the minimum of expense, both as to the power required and the cost of repairs.

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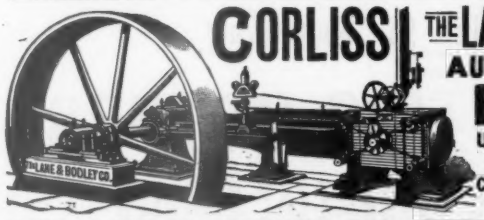

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Unrivalled for Strength, Durability and Close Regulation.

CONSTRUCTION OF COMPLETE PLANTS A SPECIALTY.

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THE SCHUYLER
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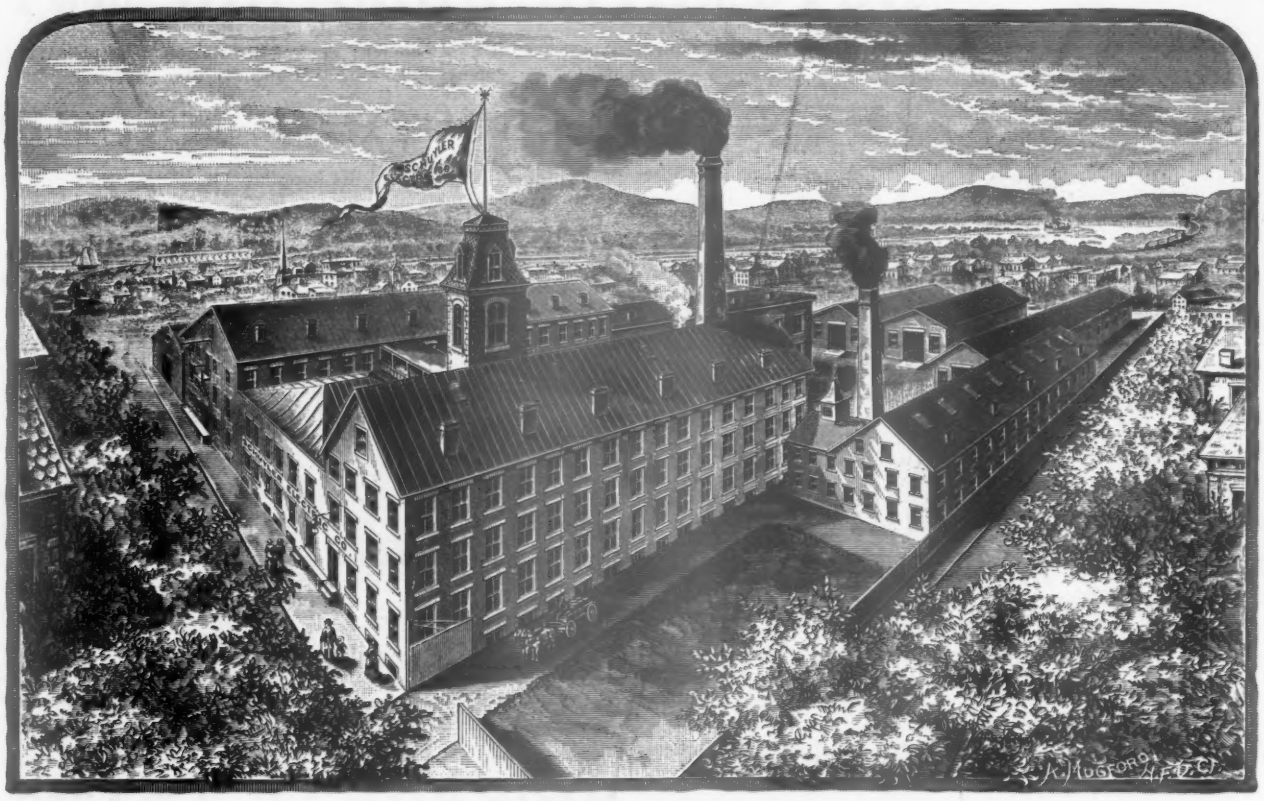
Our Ventilated Armature Cannot BURN OUT. Our Lamp has no Equal.



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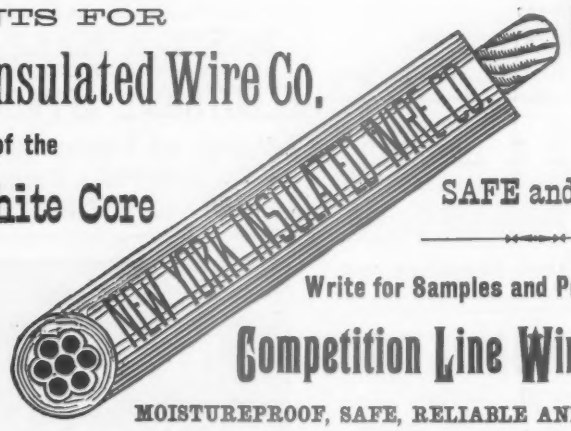

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SAFE and RELIABLE.

Write for Samples and Prices of

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MOISTUREPROOF, SAFE, RELIABLE AND CHEAP.

Grimshaw Tapes and Compound.

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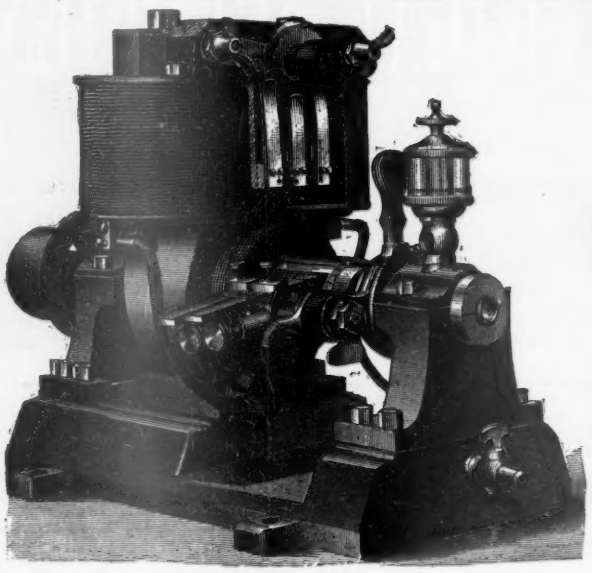

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OFFICE OF THE

United States Electric Lighting Co.

120 BROADWAY,

New York, February, 1889.

THE DEADLY PARALLEL.

From a confidential circular issued to the Edison agents, signed by **EDWARD H. JOHNSON**, President of the **EDISON ELECTRIC LIGHT CO.**, dated New York, May 31st, 1888, called forth by the decision of Judge Wallace, rendered in May, 1888, in a suit between the Edison and United States Companies:

"Neither the merits of the case nor the question of infringement has [as] yet EVEN BEEN CONSIDERED by the Court, and, as a matter of fact, the case has yet to be tried.

"The decision of Judge Wallace merely allows the defendants to take testimony under this plea, WITHOUT GOING INTO THE MERITS of the controversy, and the counsel on both sides are now engaged in taking this testimony. The decision is therefore PURELY PRELIMINARY in its character, and LEAVES THE QUESTION AT ISSUE STILL TO BE DETERMINED."

From an advertisement in the ***Electrical Review*** of February 2d, 1889, and appearing in other electrical journals, signed by **EDWARD H. JOHNSON**, President of the **EDISON ELECTRIC LIGHT CO.**, called forth by a decision of the U. S. Supreme Court, filed January 21st, 1889, in the case of the Bate Refrigerator Co., which is in fact merely a reversal of Judge Wallace's decision of May last:

"EDISON TRIUMPHANT."

"HIS PATENTS SUSTAINED

—BY THE—

UNITED STATES SUPREME COURT."

"The Edison Electric Light Co. takes pleasure in announcing to its patrons and the general public that the decision of the Supreme Court of the United States, filed on the 21st inst., in the case of the Bate Refrigerator Co., IS IN FACT A DECISION SUSTAINING THE EDISON PATENTS.

"In pursuance of our expressed determination to secure a decision upon the point of law involved, we have had the Bate Refrigerator case (covering the identical question), argued before the United States Supreme Court, with the result announced above, thus COMPLETELY DEPRIVING THE DEFENDANTS OF THEIR SOLE DEFENCE."

CONUNDRUM?

1st. How can a decision which in May, 1888, does not touch the question of infringement, or enter into the merits of the case, and which in fact leaves the case yet to be tried, become a decision sustaining the Edison patents upon its reversal in January, 1889?

2d. How can a decision which in May is merely preliminary in character, and which "leaves the question at issue still to be determined," upon its reversal in January, 1889, completely deprive the defendants of their sole defence."

EDISON TRIUMPHANT.

HIS PATENTS SUSTAINED

BY THE

United States Supreme Court.

THE

EDISON ELECTRIC LIGHT CO.

Takes pleasure in announcing to its patrons and the general public that the decision of the Supreme Court of the United States, filed on the 21st inst., in the case of the Bate Refrigerator Company, is in fact a decision

SUSTAINING THE EDISON PATENTS.

In the many suits brought by the Edison Company, in the lower courts, against infringers of the Edison Patents, the defendants have evaded the MERITS of the controversy, thus tacitly admitting the fact of infringement, and have interposed a plea alleging that our Patents have been voided by the expiration of Patents previously granted in foreign countries.

Hence the delay in establishing our rights. In the meantime other electrical companies have been indiscriminately copying our devices and methods, not even assuming that they themselves were the original inventors, but simply relying upon the construction of a statute by the lower courts invalidating our fundamental Patent. In pursuance of our expressed determination to secure a decision upon the point of law involved, we have had the Bate Refrigerator case (covering the identical question) argued before the United States Supreme Court, with the result announced above, thus

Completely depriving the Defendants of their Sole Defense.

We have now only to prove the fact of infringement in order to secure prompt injunctions against and damages from those who have been so long using with impunity that which the HIGHEST AUTHORITY now concedes to have been ours, exclusively, from the beginning. This is simply to establish

A QUESTION OF FACT.

WAS, OR WAS NOT EDISON THE ORIGINAL INVENTOR?

This question has been decided in his favor a great many times, primarily by the United States Patent Office, which granted to him Patents bearing earliest dates; then by the various courts of Europe, through the crucial examination of which the question has MANY TIMES passed.

Thus the QUESTION OF LAW having now been settled by the United States, and the QUESTION OF FACT by the highest experts of the world, this Company now notifies the public of its intention to call a halt and demand a reckoning for the trespass and abuse of its rights in

INCANDESCENT ELECTRIC LIGHTING.

EDISON ELECTRIC LIGHT CO.,

16 & 18 Broad Street, New York.

By EDWARD H. JOHNSON, President.

OFFICE OF
Sawyer-Man Electric Co.
510 WEST 23d STREET,

NEW YORK, FEBRUARY 1st, 1889.

TO USERS OF INCANDESCENT LAMPS:

The Edison Electric Light Company has recently been flooding the country with advertisements, circulars and legal notices to the effect that the Supreme Court of the United States has sustained its patents, and that it now had a monopoly of the electric lighting business, and had only to prove the possession by others of an Incandescent plant or apparatus made by some other company to enable it to collect damages from the owner, and enjoin him from its further use. Nothing could be more false and misleading than these statements, and nothing more unworthy and disingenuous than their application.

The following are the facts:

1. The case decided by the Supreme Court was on the Bate Refrigerator patent which has nothing to do with electric lighting.

2. No Edison patent has ever been passed upon by the Supreme Court.

3. The point decided was that an American patent for an invention previously patented abroad does not expire until the foreign patent ceases to exist.

4. Some of the Edison patents are for inventions which were previously patented abroad for short terms. The U. S. Circuit Court in New York had decided that these patents expired when the short terms of the foreign patents ran out, notwithstanding the fact that such terms had been extended. The only advantage of the Bate decision to the Edison Company is that it can go on with the suits on such patents where it can prove that it has extended its foreign patents in time. In such cases the defendants can put in the real defences and try the cases on their merits. Most of the Edison suits were begun in 1885. Not one of them was ever brought to a hearing. The testimony has not been closed in any of them. No Edison patent has ever been sustained in America. Many of its best patents have expired by reason of the actual expiration of prior foreign patents. It has no patent upon which it can obtain a preliminary injunction; nor has it any patent on which it can obtain a final injunction or collect damages from customers of this Company when the real defences are put in, as they certainly will be.

5. Every Edison Lamp is an infringement of the Sawyer-Man patent No. 317,676, dated May 12, 1885, which was granted after a four years interference with Edison in the Patent Office, and every treated Edison lamp is an infringement of the Sawyer-Man patent No. 211,262, and Edward Weston's patent No. 306,980, and every user of such Edison lamps is liable to the Consolidated Electric Light Company and the United States Electric Lighting Company for damages for such use.

6. Every Edison plant is an infringement of the Moses G. Farmer System patents, and every user of such plants is liable to the U. S. Electric Lighting Company for damages for such use.

7. The Edison Company has been sued on these patents, and the suits are being pressed vigorously.

8. The lamps made and sold by the Sawyer-Man Electric Co. and the United States Electric Lighting Co. are made by license under the Sawyer-Man patents.

This Company agrees to defend and guarantee all of its users against damages in any and all suits brought against them by the Edison Company for the alleged infringement of any of its patents, where it is promptly notified of such suits, and permitted to defend them.

It is suggested that the course of the Edison Co. in attempting to annoy and intimidate the users instead of proceeding against the manufacturers of competing apparatus, while quite in line with the character of its statements, will hardly commend itself to the approbation of the public.

SAWYER-MAN ELECTRIC CO.,

P. H. ALEXANDER, Assistant General Manager.

THE

WESTINGHOUSE ELECTRIC CO.

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The Pioneers of Incandescent Lighting

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Alternating Currents

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COMPLETE CENTRAL STATION OUTFITS

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— FOR —

ISOLATED LIGHTING

EFFICIENT APPARATUS.
ECONOMICAL LAMPS.
INGENIOUS DEVICES.

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Incandescent Electric Lamps,

— AND —

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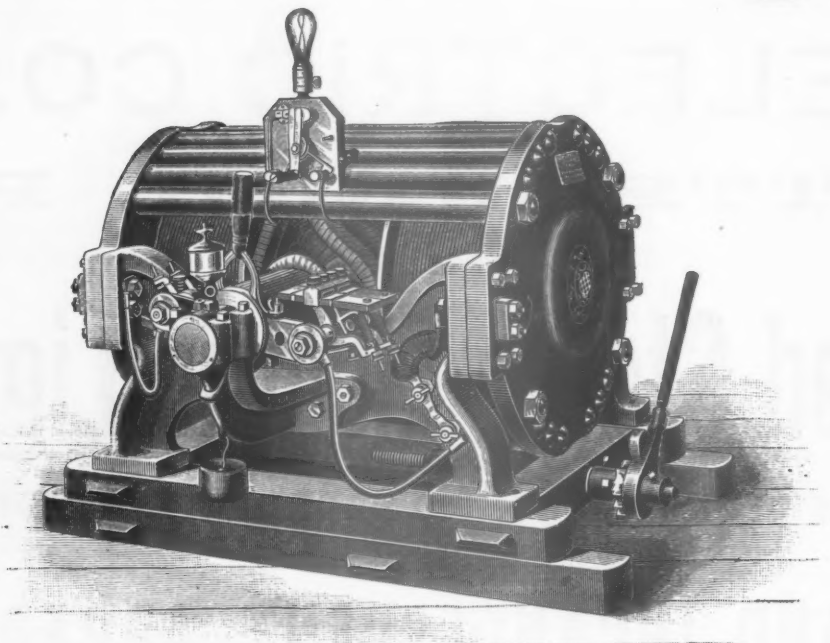

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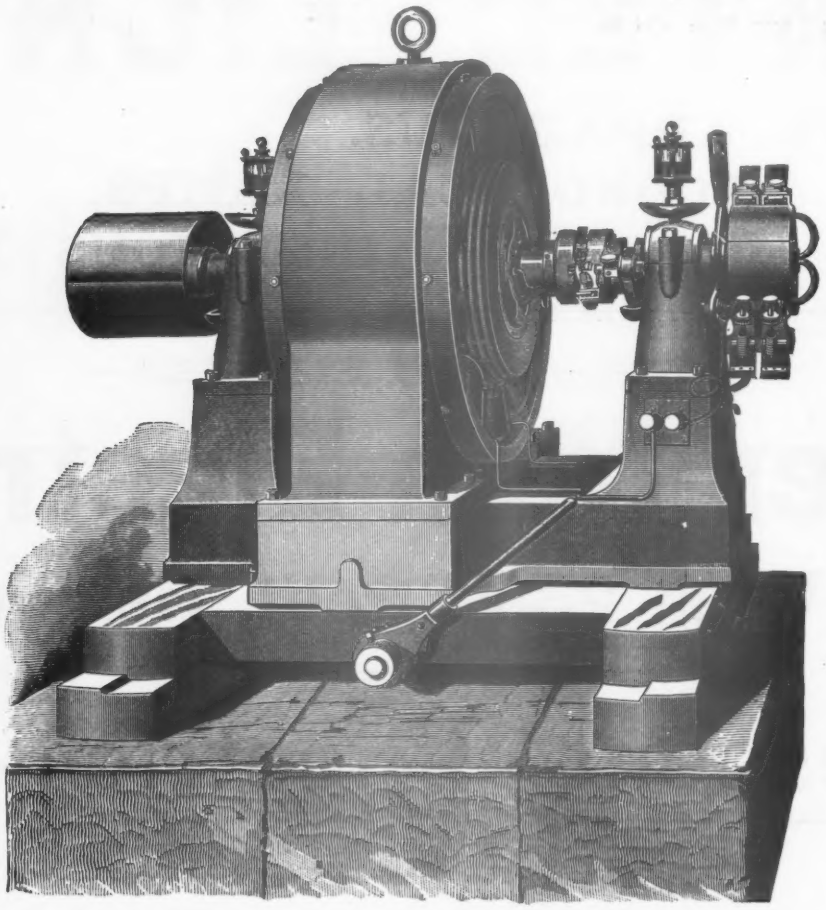
Long Distance Lighting using the Transformer or Compensator Systems.
Direct Lighting by Low Tension System.

Complete in every detail which goes to make up an efficient and reliable system.



The steadily increasing demand for the dynamos and lamps of these systems is unquestionably proof of their superiority.

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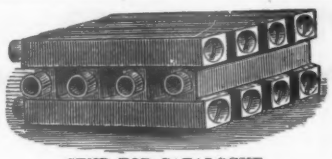
THE THOMSON-HOUSTON ELECTRIC CO.

620 Atlantic Avenue, Boston, Mass.
115 Broadway, New York.
148 Michigan Avenue, Chicago, Ill.
Kimball House Building, Atlanta, Ga.



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THE WYCKOFF PIPE CO.,

MANUFACTURERS OF

WOODEN PIPES FOR

UNDERGROUND ELECTRICAL WIRES.

We have large works for creosoting Lumber, R. R. Ties, Telegraph Poles, &c., &c.

WILLIAMSPORT, PENN.

PATENTEES AND INVENTORS.

Any one having valuable INVENTIONS, and needing money for development, may obtain funds by stating full particulars and date of Patent to Post Office BOX 356, New York.

TREASURY DEPARTMENT, Office of the Secretary, Washington, D. C., February 1, 1889. Sealed proposals will be received at this Department until 2 o'clock P.M., Monday, February 25, 1889, for illuminating the new U.S. Court House and Post Office, Baltimore, Md., by electricity. Drawings and specifications will be furnished upon application to the Assistant Superintendent of the Treasury. A deposit of twenty-five dollars will be required as a guarantee for the return of the drawings and specifications.

C. S. FAIRCHILD, Secretary.

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YOUR NAME, BUSINESS AND ADDRESS. Send at once to me and be correctly reported in Whipple's

National Electrical Directory,

A postal card will do.

FRED H. WHIPPLE,

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PHILIP K. STERN, Eastern Representative, 44 Broadway, New York.

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Electrical Engineer,

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New York City.

Detroit Electrical Works

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Special designs furnished upon application. Suggestions from architects and decorators faithfully executed.

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The Most Direct Route to the West, Northwest, South and Southwest.

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THE FAMOUS NEW YORK AND CHICAGO LIMITED EXPRESS

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This train is composed of the NEW and MAGNIFICENT PULLMAN VESTIBULED CARS, making the Safest, Easiest, and Most Luxurious Train in the World.

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849 Broadway, New York. 1 Astor House, New York. Foot of Cortlandt St., New York.
944 Broadway, " 4 Court Street, Brooklyn, N.Y. Foot of Desbrosses St.,
435 Broadway, " 1 Broadway, New York. Annex Office, Brooklyn, N. Y.
Pennsylvania R. R. Station, Jersey City.

CHARLES E. PUGH, General Manager, J. R. WOOD, Gen. Pass. Agent.
SAMUEL CARPENTER, Eastern Passenger Agent, 849 BROADWAY, N. Y.

Jarvis Engineering Co.,

ENGINEERS AND CONTRACTORS

FOR THE ERECTION OF STEAM PLANTS FOR ELECTRIC LIGHTING AND POWER STATIONS.

ARMINGTON & SIMS CO. ENGINES belted direct to dynamos. Boilers set with the JARVIS PATENT BOILER SETTING, Burning Screenings, Saw Dust Cotton Seed Hulls without blast. National Feed-Water Heaters. National Rocking Grates. Sheffield Grates. Korting Double Tube Injectors, etc., etc. This System has been introduced among the following Central Stations in the United States, Canada and other Countries, viz:

THOMSON-HOUSTON CO. SYSTEM.

*Merchants' Electric Light Co	Boston, Mass.
*Narragansett Electric Light Co	Providence, R. I.
*Woonsocket Electric Light Co	Woonsocket, R. I.
*Hartford Electric Light Co	Hartford, Conn.
*New Haven Electric Light Co	New Haven, Conn.
*Consolidated Electric Light Company	Portland, Me.
*Lewiston Electric Light Co	Lewiston, Me.
*New Bedford Electric Light Co	New Bedford, Mass.
*Fall River Electric Light Co	Fall River, Mass.
Syracuse Electric Light Co	Syracuse, N. Y.
*Bridgeport Electric Light Co	Bridgeport, Conn.
*Brocton Electric Light Co	Brocton, Mass.
Milford Electric Light Co	Milford. Mass
Gloucester Electric Light Co	Gloucester, Mass.
Bar Harbor Electric Light Co	Bar Harbor, Me.
*Bangor Electric Light Co	Bangor, Me.
Oak Island Electric Light Co	Oak Island, Mass.
Poughkeepsie Electric Light Co	Poughkeepsie, N. Y.
Norwich Electric Light Co	Norwich, Conn.
Newport Illuminating Co	Newport, R. I.
*Waterbury Electric Light Co	Waterbury, Conn.
*Worcester Electric Light Co	Worcester, Mass.
Mobile Electric Light Co	Mobile, Ala.
Intercolonial Electric Light Co	Lima, Peru.
Wachusett Electric Light Co	Fitchburg, Mass.
American Electric Light Co	Old Orchard, Me.
American Electric Light Co	Martha's Vineyard, Mass.
Saratoga Electric Light Co	Saratoga, N. Y.
St. John Electric Light Co	St. John, N. B.
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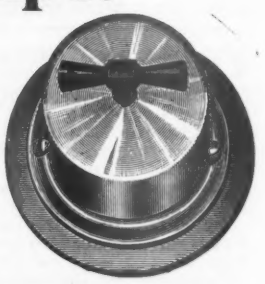

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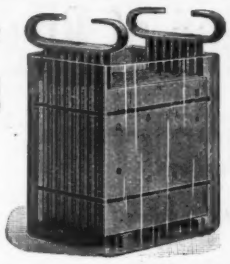

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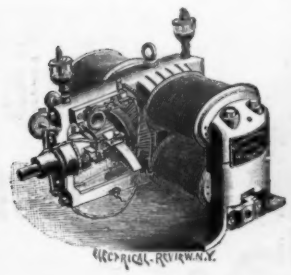

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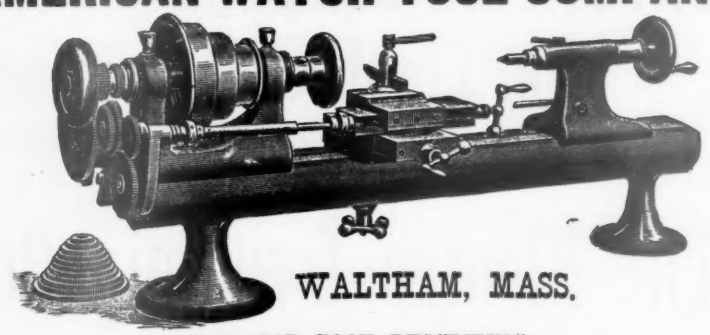

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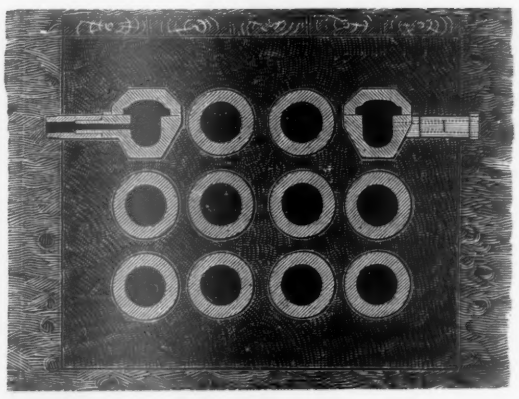

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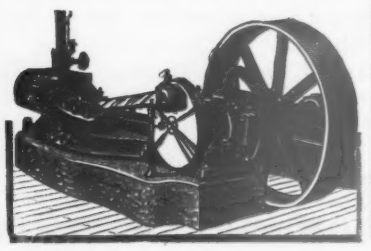

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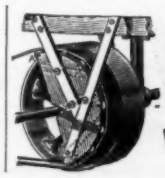

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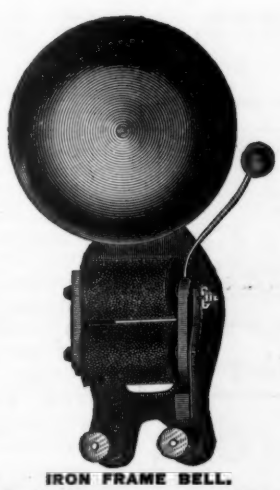

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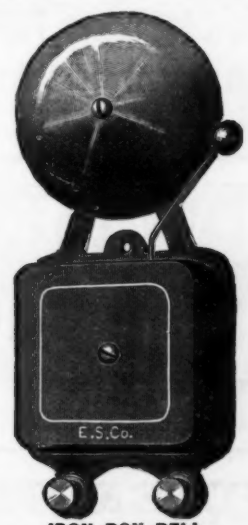

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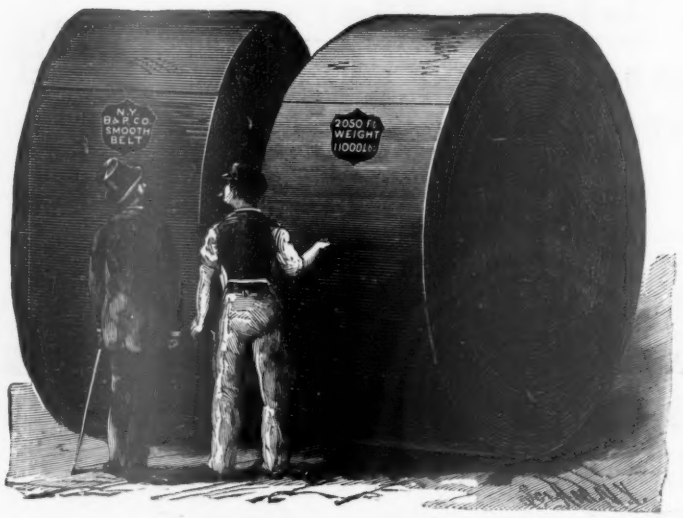

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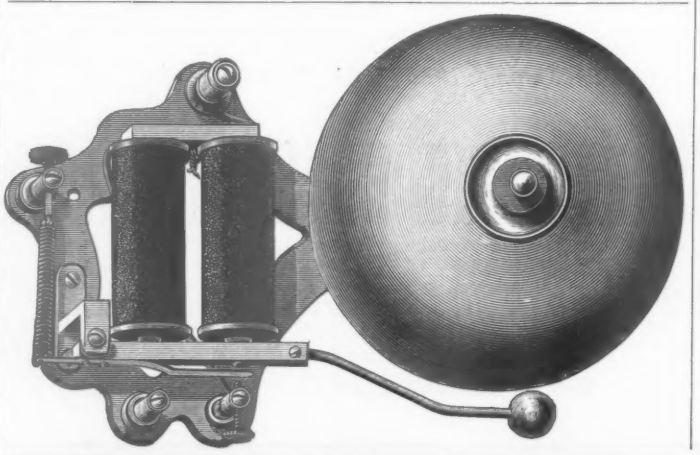

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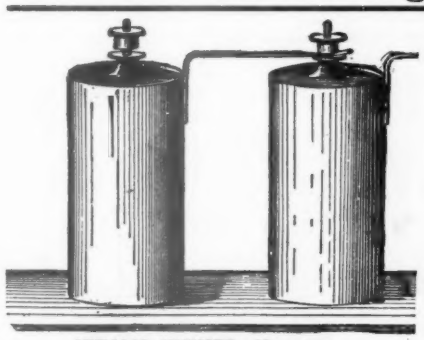

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FIG. 2.

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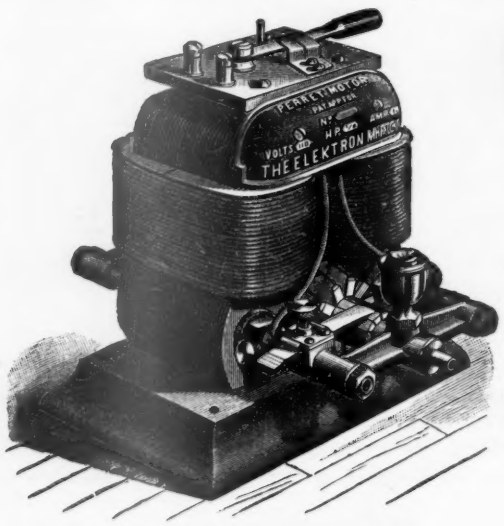

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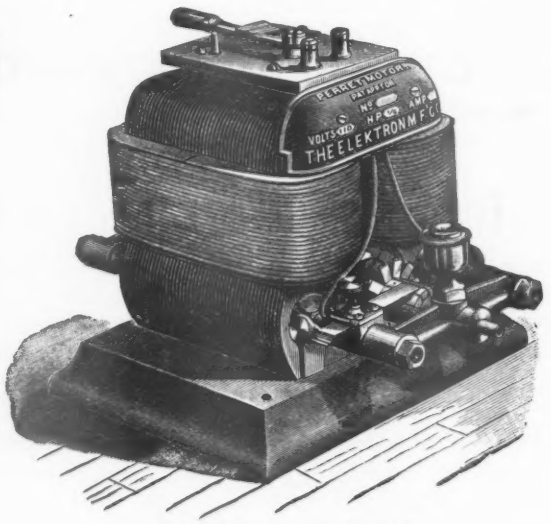

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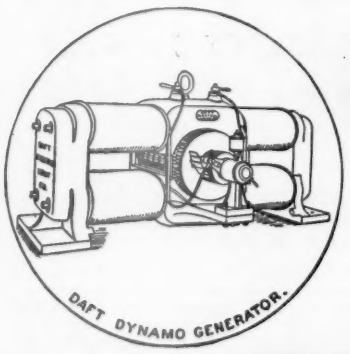

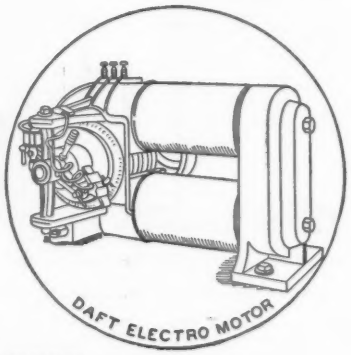

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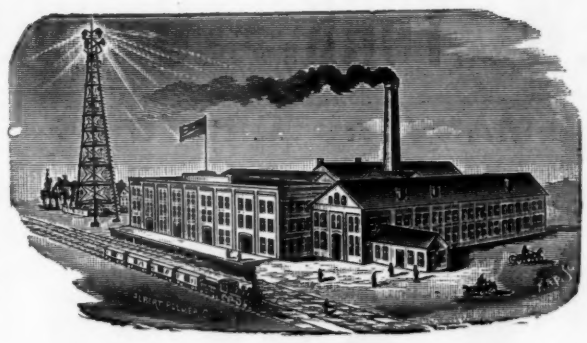

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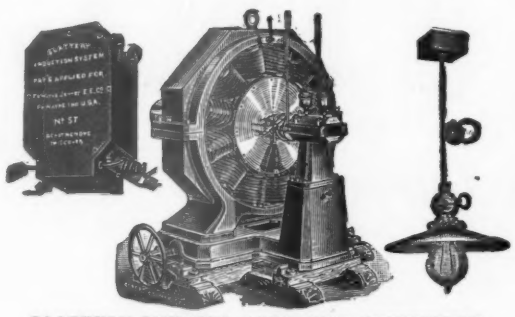

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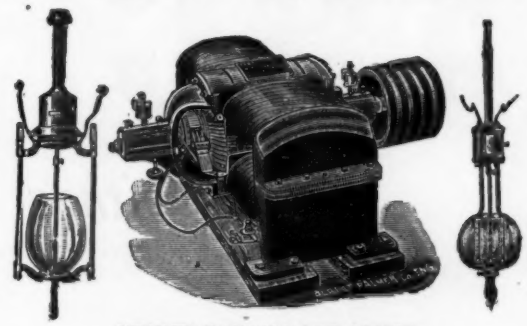

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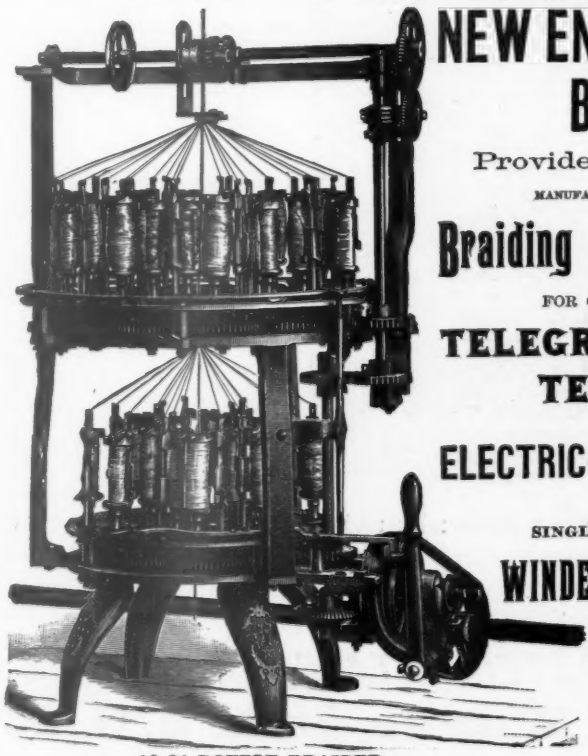

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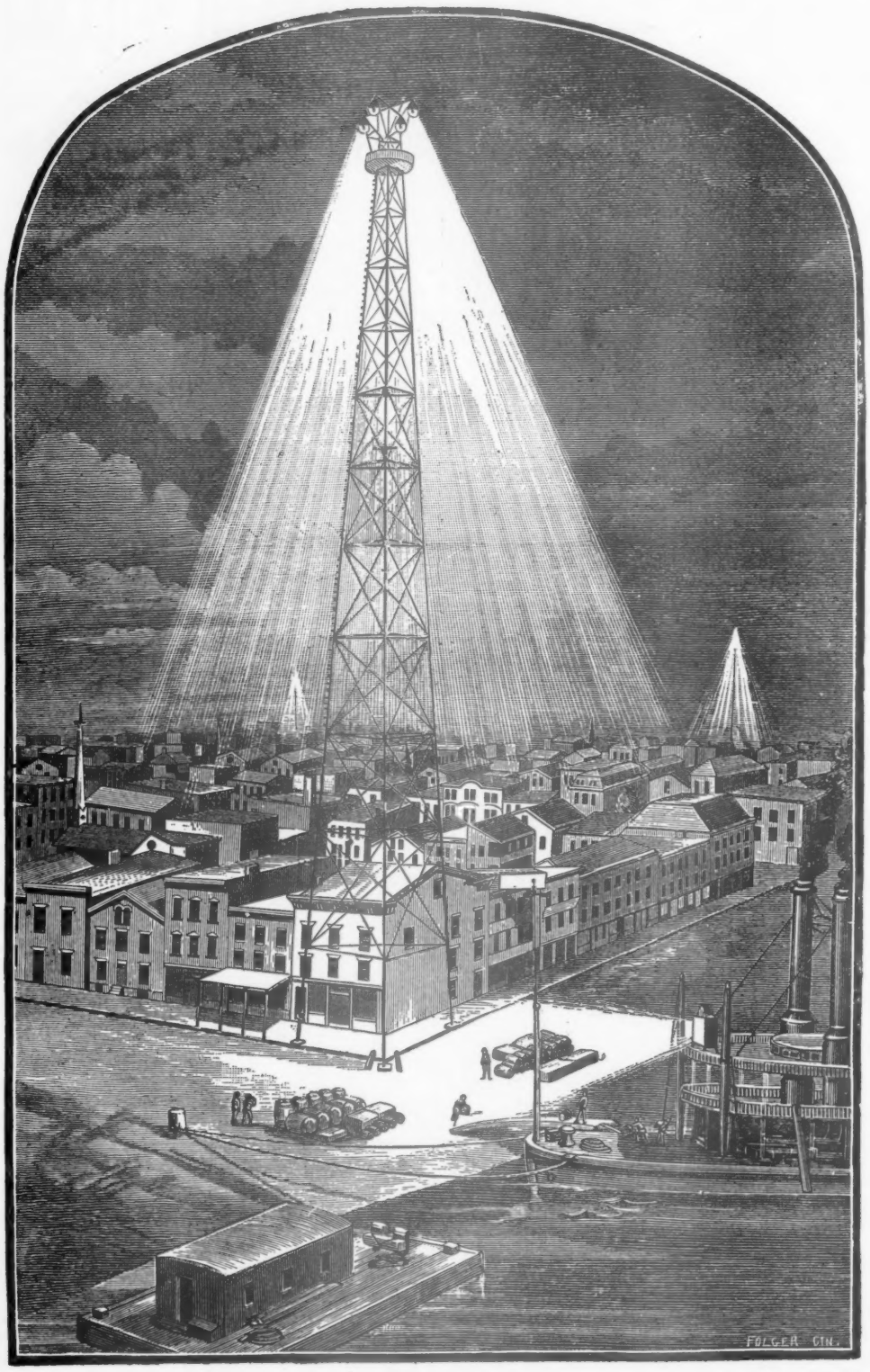

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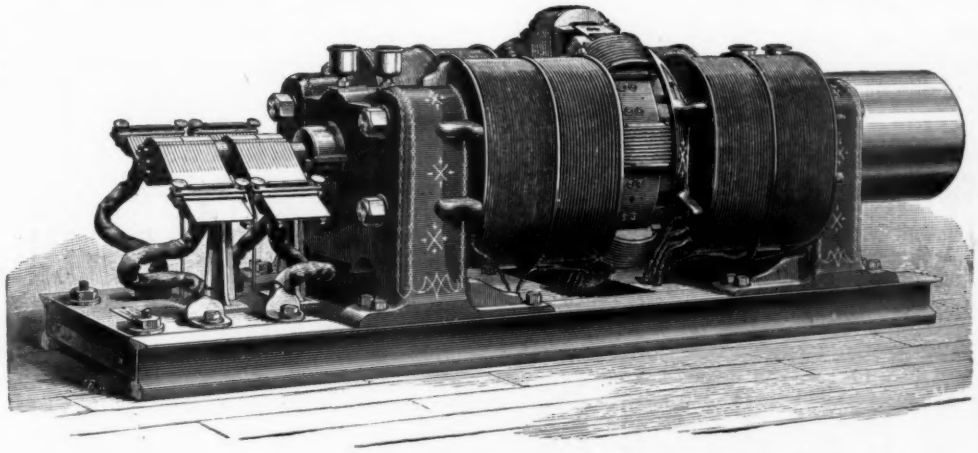

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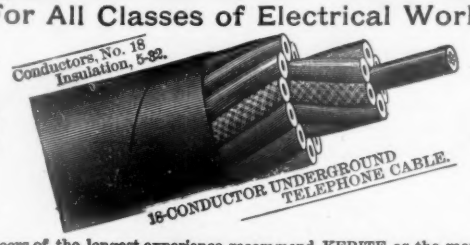

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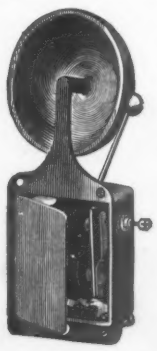

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